

THE JOURNAL OF THE MINISTRY OF AGRICULTURE

Vol. XXXVII, No. 6, SEPT., 1930

Principal Contents

	(Vol. XXXVII, No. 6)	PAGE
Statement of Accounts for the Year 1929-30		525
Land Drainage Accounts for the Year 1929-30		528
Value of Cattle and Sheep for the Year 1929-30		541
Agriculture in the Year 1929-30		553
Precautions to be Taken in the Year 1930		567
Cuthbert's Circular for the Year 1929-30		571
New Forestry in the Year 1929-30		571
Effect of the Year 1929-30 on the Natural Composition of the Forests of England and Wales		571
Markets for the Year 1929-30		571
The Production of the Year 1929-30		571
Agriculture in the Year 1929-30 of England and Wales, 1930		571



LONDON.

PUBLISHED BY HIS MAJESTY'S STATIONERY OFFICE

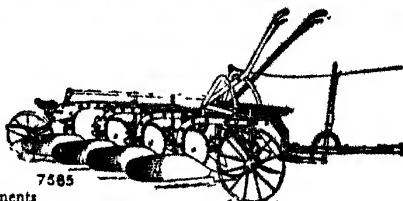
To be purchased directly from H.M. STATIONERY OFFICE at the following addresses:
Admettal House, Kingsway, London, W.C.2; 120 George Street, Edinburgh;
York Street, Manchester; 1, St. Andrew's Crescent, Cardiff;
15, Donegall Square West, Belfast;
or through any Bookseller.

Monthly. Price 6d. Net. Post Free.

Editorial Office: 20 Whitehall Place, London, S.W. 1.
47, Grosvenor Street, London, E.C. 2.

Advt. Contractors: Walter Judd, Ltd.,
Tel. 1 National 8343.

FOR EFFICIENCY &
ECONOMY



ANTICIPATING the requirements of Farmers in these days of mechanisation, Ransomes are particularly to the fore in the development of Tractor Ploughs, manufacturing a complete range suitable for all types of Tractors.

The Implements now offered by them, incorporating all the very latest improvements, are the most efficient and economical obtainable.

You are sure to find a Plough suitable for your own special requirements in Ransomes' range.

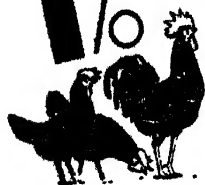
Write for full particulars and catalogue, free on application to
RANSOMES, SIMS
& JEFFERIES, Ltd.,
Orwell Works, Ipswich

USE A Ransomes' TRACTOR PLOUGH

1% of Cod-liver oil
added to the usual
poultry ration supplies
all the Vitamins A & D
necessary to growth
and health at the low
cost of 8d per cwt of
foodstuffs thus treated

1/2 bo's. (12 to gall.)	1/3
Bottles (6 to gall.)	2/-
1/2 gall. tin	3/9
1 gall. tin	6/6
5 gall. tin	31/-
25 gall barrels	145/-

Obtainable from Chemists.



but it must be

'PLOUGH' BRAND COD-LIVER OIL

Manufactured by
ALLEN & HANBURYS LTD.
LONDON, E.2



Please mention the JOURNAL when corresponding with Advertisers.

THE JOURNAL OF THE MINISTRY OF AGRICULTURE

Vol. XXXVII. No. 6.

SEPTEMBER, 1930.

NOTES FOR THE MONTH

THE following statement on agricultural policy was made in the House of Commons by the Rt. Hon. Philip Snowden, M.P., Chancellor of the Exchequer, on

Statement on August 1 :—

**Agricultural
Policy**

(1) In view of the depression which exists in certain branches of the agricultural industry, and the urgent need for reform in methods both of marketing and production in order to take advantage of our valuable home market, the Government have given anxious consideration to the agricultural problem, with especial regard to the desirability of increasing employment on the land with good standards of living, recognizing that this can only be assured through prosperity in the industry.

(2) *Holdings for Small Cultivators.*—Proposals will be submitted for making land more freely available for small cultivators and affording them adequate security of tenure.

Local Authorities will be stimulated to meet the large and unsatisfied demand for small holdings, cottage holdings and allotments. In addition, the Minister of Agriculture will be given powers to acquire and manage land for these purposes, so as to supplement but *in no way to supplant* Local Authorities that are active. Powers to provide cottage holdings will be extended to County Borough Councils, and these holdings will be made available for letting as well as sale, and for a wider class of applicant.

Unemployment Scheme.—A scheme will be undertaken whereby a contribution may be made to the mitigation of unemployment by the creation of a special class of allotments and of market garden and poultry holdings up to 5 acres for suitable unemployed workers.

(3) *Large-Scale Farming and Demonstration Farms.*—An Agricultural Land Utilization Corporation will be established

to conduct, on the one hand, large-scale farming, managed on business principles, with the utmost possible application of improved methods and the best machinery, with the particular object of affording to agriculturists a practical training in business management; and on the other hand, additional Demonstration Farms of various types in different parts of the country, designed to secure the quicker and more general adoption of every agricultural improvement.

(4) *Scotland*.—In Scotland, the Department of Agriculture will make every effort to increase the number of small holdings available. At the same time investigations will be set on foot for improving certain large tracts of barren and moss land and for reclamation works. Arrangements are under consideration for the extension of the Agricultural Credits Act, 1928, to Scotland.

(5) *Cereals*.—The critical position of cereal farmers demands the earliest possible attention. The question of the condition of this class of agriculturists in different parts of the Empire will be discussed at the forthcoming Imperial Conference with special reference to Bulk Purchase, Import Boards and Stabilization of Prices. In view of this, and of the possibility that the conclusions of the Conference on this matter may materially change the practical problem of dealing with cereal farming, the Government is not in a position at present to formulate comprehensive proposals for this part of the agricultural situation beyond the plans outlined in this statement for improved methods of cultivation, the better organization and marketing of produce, education and research, and improved credit facilities. But as soon as the conclusions of the Imperial Conference are known the Government will undertake whatever practicable steps can be devised to put cereal growing in this country on an economic foundation.

(6) *Agricultural Marketing Bill*.—It is an urgent necessity to give our home producers opportunities of orderly and better marketing in our industrial market.

A Bill is being introduced forthwith for purposes of criticism and comment, which offers certain powers to large-scale commodity organizations initiated by producers themselves for the marketing of home-produced agricultural products, and protects such organizations from the disruptive action of minorities. There are precedents for legislation of a similar kind in overseas parts of the Empire.

The Bill contemplates organizations of two distinct types, though combinations of both are possible. First, there is the older and better-known pool type which is well adapted for products in respect of which we are largely self-supporting and of which the market may be disturbed by recurring surpluses. The Bill also provides for organizations of the regulatory type which are concerned more with the craft of marketing than with the physical control and handling of the product, and which, after the manner of a board of directors, would formulate a coherent marketing policy for the home product and carry it into effect.

Financial assistance by way of both long and short term loans will be available for these commodity marketing boards.

Care has been taken to provide safeguards for the great body of consumers and for other affected interests.

(7) *Abattoirs*.—The erection of publicly-owned abattoirs by Local Authorities for the centralized slaughtering of live stock will be encouraged.

(8) *Education and Research*.—The development of agricultural education will also form an important part of our policy. An Agricultural Research Council is being constituted to secure improved co-ordination and extension of agricultural research throughout the United Kingdom. In view of the great losses incurred through disease, among the first subjects to receive attention will be contagious abortion, tuberculosis and swine fever.

(9) *Scrub Bulls*.—Legislation will be introduced to regulate the use and import of bulls, with a view to improving the standard of our livestock.

(10) *The Agricultural Worker*.—Apart from the increased provision for access to land for their own cultivation that the policy affords to suitable workers, it is important that agricultural workers should share in any added prosperity which may accrue to the industry, and the working of the existing machinery for regulating wages will be carefully watched with this object in view.

(11) *Housing*.—The present Housing Bill contains provisions which should mitigate the evil of the tied cottage, to which we attach great importance, and it is the intention of the Government to take special steps to stimulate the provision of improved housing in rural areas under the powers therein provided.

Further, a Committee which is to be appointed to consider the Rent Restriction Act will include within its purview the special position of the "tied cottage," with a view to providing a remedy against any unfair use of this system.

(12) *Conclusion.*—The Government is convinced that by a sustained and well-directed effort designed to evoke the co-operation of the industry itself it should be possible to arrest the decline of employment on the land, and to foster, by taking advantage of modern developments and facilities, specialized and improved methods of production which should result in a great increase in our home-produced food supplies and bring back prosperity to our countryside. It is believed that these proposals will have the effect of inspiring in all sections of the farming community that confidence which is so essential to its progress and welfare, and will promote the sound development of the great agricultural industry.

* * * * *

The Land Drainage Act, 1930, is the result of the report of a Royal Commission on Land Drainage set up on March 26, 1927, under the Chairmanship of Lord Bledisloe, which completed its task of investigation and reported on December 5 of that year.

**Land Drainage
Act, 1930**

The Act marks the beginning of an important new era in the history of Land Drainage Law. The law which the Act replaces extends over a period of several hundred years, dating from Henry VIII and even earlier times, and has been described at different times as anomalous, obscure, vague, ill-defined, lacking in uniformity, and even chaotic.

The Act is a consolidating and amending Act, but at the same time it introduces certain important new principles.

Up to the present time, the Law of Land Drainage has provided facilities for the setting up of drainage districts on a comparatively restricted basis, owing to the fact that its underlying principle has been that only those who benefit by, or escape danger as the result of, drainage operations have been liable to pay drainage rates.

The limitation thus placed upon the powers hitherto existing has rendered it impossible, in normal circumstances, to bring within the scope of one comprehensive Drainage Board any considerable river or the area served by it, owing to the difficulty of finding from the area which could be legally rated (*i.e.*, the area of benefit or the area of escapement of

danger) sufficient money to meet the cost of maintaining that river, without crippling the resources of the district.

It is true that an attempt was made in 1920 in the case of the Great Ouse to place the bulk of the main river under the jurisdiction of a Drainage Board constituted under the then existing law, but the experiment did not prove successful, and the difficulties of rate collection that arose in that district, where something of the nature of an impasse was created, tended to spread to other districts.

Accordingly when the Royal Commission came to review the situation they realized that the fundamental defect in the law of land drainage was that the area of rating was inadequate to secure the carrying out of comprehensive works on the larger rivers, which were consequently becoming neglected and increasingly unable to carry away the water poured into them, either naturally by gravitation or artificially by pumping, from the areas of the many small drainage boards who were doing their utmost to keep their smaller arterial drains in an efficient state.

The Commission recommended, therefore, that the catchment area of each river, viz., the area bounded by what is geographically known as the "watershed" or "water parting," should be the unit for land drainage, and that a comprehensive body, to be known as a Catchment Board, should be set up where necessary for each such catchment area with full control over the main river within the area, and a general power of supervision over the smaller drainage boards which now exist, and which will continue to exist in the future on the old basis of area of benefit and escapement of danger.

The Commission also recommended (and this is perhaps the most drastic of their reforms) that the whole catchment area should contribute towards the cost of the main river works, while the Internal Drainage Districts (who would continue to exercise their functions) should continue to find the cost of their internal operations from their own areas, and should, at the same time, be liable to contribute towards the cost of the Catchment Board's operations.

The Catchment Board will thus be in a position to do all that is necessary on the main river, and to obtain the necessary funds for so doing, by precept, from two sources, viz., from the County Councils and County Boroughs within the area, and from the Internal Drainage Boards within the area.

In this connexion it should be realized that the County Council precept will be raised in the same manner as any other County and County Borough rates, viz., without any contribution from agricultural land and with only a partial contribution from productive industry. On the other hand, the contribution to be found by the Internal Boards will be levied on all hereditaments, as "derating" does not apply to drainage rates.

It is true that large areas (including urban areas in the upper reaches of a river, whose contribution to the waters of a river are ever increasing, owing to the constant spread of urban development) are under the Act placed, for the first time, under an obligation to contribute towards the expenses of maintaining the river for drainage purposes. On the other hand, the new Catchment Boards are thus assured of adequate financial resources to carry out the vital task of putting the main rivers of England and Wales into a state of efficiency.

So far as the drainage of areas served by tributary rivers and smaller streams, artificial and otherwise, is concerned, the Authorities existing prior to the passing of the Act will continue to function, but with the more adequate and up-to-date powers conferred upon them by the Act. Ample facilities are provided for the setting up of further Authorities of this nature wherever required. The area which these Authorities will control will still be upon the old basis of benefit or escape-ment of danger, but they will in future carry out their powers with the knowledge that there is operating upon the main river (into which the waters of the Internal Board ultimately discharge) a comprehensive Authority competent to carry out the necessary works and armed with the necessary financial resources.

In conclusion it must not be overlooked that the Government have recognized the principle of affording financial assistance to the new Catchment Boards in the execution of their duties, and the Act provides that Government contributions can be obtained by Catchment Boards in the carrying out of new works and the improvement to existing works. This does not in any way interfere with the present financial facilities which are being afforded to existing Drainage Authorities, either under the programme of the Ministry of Agriculture and Fisheries or under that of the Unemployment Grants Committee. These financial facilities will continue so long as the Government's Unemployment Relief programme is in existence.

IN the next issue of this JOURNAL an article giving an account of the fourth World's Poultry Congress which was held at the Crystal Palace from July 22-30 will be published. It was a pleasure to welcome so many and varied visitors from such a multitude of countries; the one "fly in the ointment" was one's limitations as to language, though English, French and German will usually suffice to meet all the needs of such functions. Yet other European languages, Japanese or almost any tongue would have been useful.

**Impressions of
the Poultry
Congress**

Taking a systematic walk round the exhibits, and bearing this JOURNAL in mind, one was irresistibly drawn by the words of Burns:—

"A chiel's amang ye takin' notes,
An' faith he'll prent it."

Those who attended the Congress in a really interested capacity—whether official, as practical producers or from the trade standpoint—must have felt the liveliest satisfaction at all they saw, and have left subsequently with the happiest recollections of friends made and a good cause served. May many of them meet again at the fifth Congress to be held three years hence in Italy!

There was much at the Congress which was calculated to leave lasting impressions—and impressions of varying type. The opening by H.R.H. The Duke of York; the indefatigable attentions of the organizing staff; the energy and propagandist capacity of Mr. F. C. Elford and Sir Edward Brown; the wonderful exhibits of Canada, the United States, Germany, Northern Ireland, the Irish Free State, the Empire Marketing Board, the Ministry's marketing demonstration, etc.; the highly interesting and educational films in the cinema; the 172 papers presented by delegates and others; the trade displays; the choice and varied exhibits of poultry, comprising in all some 7,000 head; all these and much more—not forgetting the delightful music—combined to fascinate delegates, other members and public alike.

Among the poultry were very many breeds which few British poultry keepers can have seen or heard of before. Glancing at them at random, one noted the Plymouth Buffs, Buttercups and Bourbon Red Turkeys from the United States; the Japanese Sumatra Blacks and Silkie Whites; Partridge Styrians and White Capouns from Yugo-Slavia; Keeskemet bare-necks from Hungary; Nakthahns and the

pearly or opal Porzellan bantams from Germany ; the Aseel and Karah Nath breeds from India ; Wittekraaikoppen, Lakenvelders, Welsummers and Witkuiven from Holland ; the English Marsh Daisy ; Polverara Blacks and Ghigi's Bantams from Italy ; and the attractive series of Italian guinea fowls, including the Mitrata, Crested, Vulturine and Ghigi's Blue. Some of these breeds are found occasionally in England ; the Silkie, for example, has been used in breeding experiments, and the Welsummers appears to be a promising breed which produces large dark brown eggs, and is already being kept on a poultry-farm scale.

Wandering hither and thither in the Palace, one was disposed to wonder whether such a babel of tongues spoken by the representatives of the sixty nations taking part in the Congress had ever resounded since the Babel of the Old Testament. Perhaps the one common tongue—and certainly the most incessant—was that of the thousands of fowls ! At one spot were met several small boys carrying paper bags with literature of the Scientific Poultry Breeders' Association, and an expression of the hope that they would read their collection elicited the ungrammatical reply, "My dad will, not me."

It ought to be mentioned that a number of new Bulletins on poultry subjects, just issued by the Ministry, were on sale at two publications stands, and some 1,375 copies were sold.

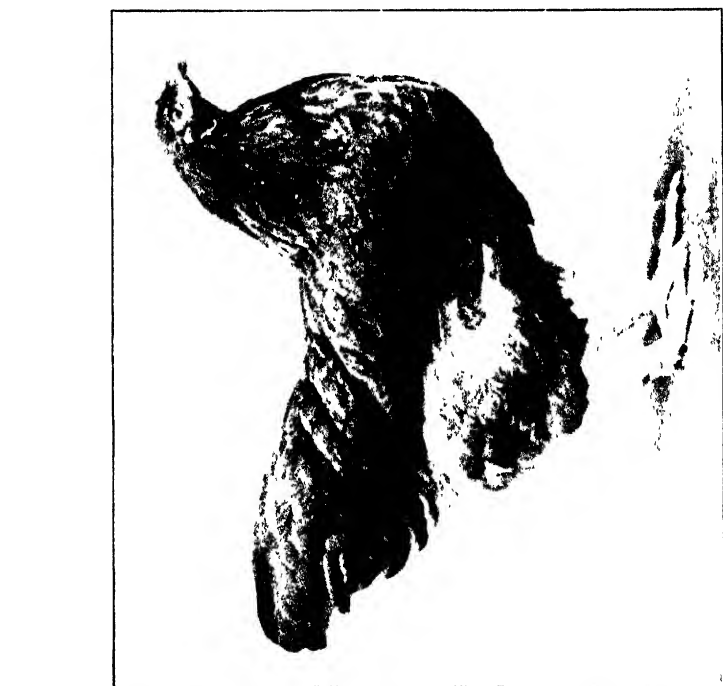
At the Government luncheon before the opening ceremony, it was stated by Earl de la Warr, Parliamentary Secretary of the Ministry, that this country imports poultry products to the value of £70,000 daily. Is not this fact alone sufficient hint to our farmers ?

The full results of the Congress may not be apparent for some months, perhaps even years, but it can safely be said that the Congress was a resounding success.

* * * * * *

IN an earlier issue of this JOURNAL (October, 1929) particulars were given of grants which the Ministry was authorized

<p>Field Drainage, Water Supply and Claying of Fenland : Assisted Schemes</p>	<p>to offer towards the cost of approved schemes of field drainage and water supply, with a view to the improvement of agricultural land and conditions in rural areas and the alleviation of unemployment. Reference was made in the May, 1930, issue to the extension of grants to schemes</p>
--	--



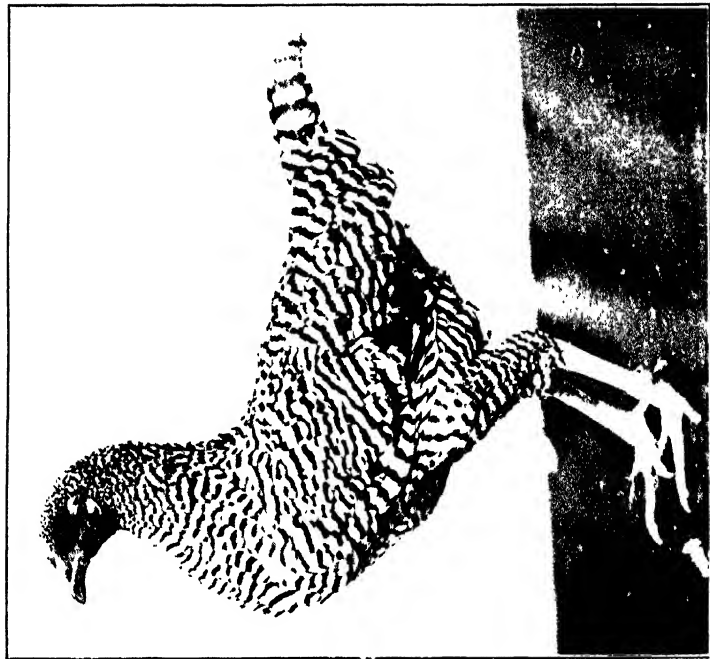
Partridge. Photograph by Mr. John J. White, 1900.



Pheasant. Photograph by Mr. George H. Marquis de Donville, 1900.



Black Sumatra Cock. Imported by Mr. Percy Briggs. London.
Went's Poultry Company, 1930



Red Chukar Cock. Imported by Mr. K. Went. London.
Went's Poultry Company, 1930



Fig. 1. Silver Gamecock.
 Silver Gamecock, bred by the author, 1930.



Fig. 2. Golden Gamecock.
 Golden Gamecock, bred by the author, 1930.



Silver Pouter. Exhibited by Mr. G. B. K. at the New York
World's Pottery Congress, 1899.



Black Game. Exhibited by Mr. G. B. K. at the New York
World's Pottery Congress, 1899.



Photo. C. H. Co. I.
Dutch Land Hoop. Exhibited by Mr. H. L. Hestrop, Plymouth



Portugal Capon. Exhibited by the Countess Maria A. Herberstein
(Yugoslavia)

World vs. Poultry Congress, 1930



Original Dutch East Indian Pintail Duck, Exhibited by Captain
H. Beckhous, Northlands Estate, (Indo 2,)
WORLD'S POULTRY CONGRESS, 1930



Pintail Duck
Exhibited by the Sociedad Rural
Argentina, Buenos Aires, Argentina

for the claying of fenland. The position at the end of July with regard to the various schemes was as follows :—

	<i>Schemes approved</i> No.	<i>Work provided</i> Man-months	<i>Estimated cost</i> £	<i>Ministry's commitment</i> £
Field Drainage . .	421	2,223	44,072	15,200
Water Supply . .	114	3,073	81,800	32,479
Claying	33	225	1,613	538

Brief particulars of a few of the schemes may be of interest.

1.—A scheme of water supply to 22 farms, covering an area of 10,000 acres and estimated to cost some £10,000, is now well in hand and is giving employment to 26 Welsh miners and 24 local unemployed. The Estates Surveyor speaks most highly of the way all the unemployed are working, particularly the Welsh miners. He states that they are an exceedingly nice lot of men, but that when they arrived they were thin and anæmic-looking. When the Ministry's Land Commissioner saw them on a recent visit, however, they were full of health and happiness and those with whom he spoke expressed great appreciation of all that was being done for them. As a matter of interest, they have applied for permission to give a concert in aid of the local hospital before they leave the district. The owner's wife has purchased the necessary music and provided a piano, and Welsh harmony is heard in the village each evening.

2.—Another scheme provides a gravity water supply to an agricultural village and four dairy farms of approximately 2,500 acres. The majority of the pastures rely for their supply on small ponds fed by surface water, and on the higher ground on dew ponds. The supply to the cottages is rain water caught from roofs or water carried from springs several hundred yards away. There is a spring of wonderful capacity near the village and the scheme approved by the Ministry, estimated to cost some £3,500, provides for the use of this water by means of a pumping station, the power being derived from a stream, and a 20,000 gallon reservoir on the highest part of the parish, whence the water will gravitate to the various properties to be supplied and to concrete troughs for watering the meadows and downs.

The work is nearly completed and it is giving employment to 15 transferred miners and 7 local unemployed. The miners have settled down quietly in the village, and the contractor has paid many compliments regarding them. He was sur-

prised at the amount of work they performed, and he only wished he could at all times rely on obtaining such satisfactory unskilled labour.

3.—A third scheme, estimated to cost about £500, is for a water supply to a dairy farm carrying some 80 head of stock, with adjacent cottage. The present supply, derived from springs, is totally inadequate and of doubtful purity. The supply failed entirely in 1929 and the tenant was obliged to dispose of the whole of his stock and his three milk rounds within a fortnight. He states that this is the heaviest blow he has received throughout a long farming career and that he could hardly survive another such period.

The proposed scheme is to augment the existing supply from a shallow well already sunk near the homestead. By cutting a long trench to expose further water-bearing strata it is hoped to obtain a yield of 1,000 gallons a day. A pump and engine will be erected over the well, and the water will be lifted to a raised storage tank from which the farm house, labourer's cottage, six meadows and farm buildings will be supplied.

4.—On learning of the Ministry's offer to make grants in aid of schemes of claying on fen lands, the Norfolk County Council announced to the tenants on their small holdings estate that in the case of any claying scheme undertaken by a tenant which is approved by the Ministry for a grant of $33\frac{1}{3}$ per cent. of the cost, they would, as landlords, contribute a similar proportion. The cost, therefore, of any approved schemes of claying undertaken by these smallholders is borne equally by the tenants, the Council and the Ministry. Applications were received from twelve tenants and duly approved. More are expected next season.

THE Imperial Horticultural Conference, referred to on p. 426 of the August issue of this JOURNAL, was duly held from

August 5-7. On the economic side of

**The Imperial
Horticultural
Conference**

fruit production, Mr. F. L. McDougall noted the increase of fruit consumption after the War, especially of grapefruit, oranges, canned fruit and prunes. Empire

produce faced keen competition chiefly from the United States, the Levant and Russia. Mr. J. L. Brown outlined the evolution and working of the New Zealand Fruit Export

Control Board. A United Kingdom representative advised as to disposal of stocks here.

The Administrative Side of Horticultural Research.—Dr. W. T. Macoun described the centralized system of Canada from its inception in 1887. The advantages were quick availability of results, co-ordination of work, avoidance of overlapping. The standpoint of an unattached Station was given in a paper by Mr. E. F. Palmer (paper read by Dr. Macoun), director of the Vineland Experimental Station, Ontario. Dr. B. Hahne's report outlined research projects in the Union of South Africa, among the most important being those on citrus and vines.

Dr. A. C. D. Rivett noted that a comprehensive study of insect pests was being made in every State in Australia, and that attention was being paid to soil science in irrigation areas. Special attention was devoted to apples in Tasmania since the reorganization of its research department. Co-operation between Commonwealth and States was necessary for success.

Dr. W. Burns, dealing with research in India, notably in Bombay, stressed the importance of transport and marketing problems.

Sir Frederick Keeble outlined the work of the research station of the British Chemical Industries at Jealott's Hill. Mr. W. G. Freeman dealt with difficulties encountered by the growers of tropical and sub-tropical fruit and their best lines of attack, with special reference to citrus fruits, bananas, avocados and mangoes.

Horticultural Experimentation.—Sir Daniel Hall noted the large number of problems needing solution, instancing among others the improvement of English-grown asparagus, cultural treatment of roses, the handling of tulip bulbs, etc. Mr. T. N. Hoblyn considered that the failure of earlier research on fruit trees was due to the inherent variability in the trees themselves and variation due to outside causes. These causes of error could now be eliminated by the adaptation of statistical methods to known material raised clonally. Examples were given from experiments at East Malling. Professor E. E. Cheesman thought that the same inherent variability was markedly noticeable in tropical crops, which were largely cross-fertilized and heterozygous. Here, too, in dicotyledons clonal propagation seemed to offer a solution. He instanced cacao, which was at present under investigation at the Imperial College at Trinidad. In the subsequent discussion

emphasis was laid on the desirability of close contact between the statistician and the horticultural worker, and on the importance of the close observation of individual trees in horticultural experiments. Dr. F. J. Martin showed, from instances in West Africa, that statistical methods were applicable there.

The Application of the Pure Sciences to Horticultural Problems.—Professor B. T. P. Barker considered that chemistry could help the cider industry, particularly by determining the constituents of the apple. Apples other than pure cider varieties could be used to supplement these. Investigations were in progress on the substitution of centrifuging for filtering. Professor V. H. Blackman noted that the physiological study of the effect of external conditions on horticultural crops was complicated by the inter-relationship of various factors. The solution of the stock-scion problem might possibly lie in some balance of processes, *e.g.*, enzymic action, or of ratio of assimilation to respiration. Dr. E. J. Maskell gave notes on the following very important physiological problems of cocoa: shade—seasonal march of vegetative growth—pruning effects—effect of fertilization and of nutrition on failure to fruit—fluctuations in cropping curve.

The Relation of Soil and Climate to Fruit Production.—Fruit soil surveys in this country and in Australia were discussed by Mr. T. Wallace and by Professor A. J. Prescott (paper read by Dr. A. C. D. Rivett) respectively. Soil surveys had established relationships between soil characters and the following: tree failures, growth characters, incidence of certain pests and diseases, fruit qualities. In discussion Dr. A. W. Joseph noted the need for uniformity of work and terminology in soil surveys. Mr. H. V. Taylor outlined the British scheme of research for meteorology as affecting fruit production.

Fruit Storage Methods.—Dr. Franklin Kidd divided the problems into two groups: (1) those concerned with reduction of wastage and improvement of quality, using present methods, (2) those connected with the evolution of new methods. Local testing of storage qualities was desirable, as also investigations into trade practice in handling between producer and consumer. The effects of numerous volatile substances in atmospheres of stores needed further investigation. Mr. T. Wallace noted results of experiments at Long Ashton on many factors affecting storage quality, *e.g.*, rootstocks, age of tree, manures, cultivations, pruning, thinning, ring barking, time of picking,

size of fruit, and the inter-relationship of the above factors. Dr. A. Horne dealt with the infection and invasion of the apple fruit by fungi and their effect on storage quality. The presence of high fungal numbers and many pathogenic forms in an orchard were in certain cases associated with considerable wastage under ordinary storage conditions, and low numbers and few pathogenic forms with little wastage. Resistance to invasion differed greatly. Miss H. K. Archbold showed how prolonged storage life of the apple was generally associated with a slow rate of loss of oxidizable material in respiration. Time of picking greatly influenced the chemical composition and hence the storage qualities of the apple. Mr. R. C. Palmer (paper read by Mr. W. T. Hunter) also stressed in the case of the Jonathan apple the importance of the time of picking, and showed how the basal colour of the apple could serve as an adequate guide. Drs. L. P. McGuire and C. W. Wardlaw (paper read by Professor E. E. Cheesman) described the storage qualities of certain banana varieties immune to main stalk rot, and methods for reducing wastage in transport. Mr. R. G. Tomkins dealt with the biological effect of atmospheric humidity on fruit in storage, noting its possible success in checking certain rots, its value in prolonging storage life and the practical difficulties met.

Mr. Meirion Thomas described the condition known as "Aldehyde poisoning," noting that it could be distinguished from brown heart by chemical analysis, and from other injuries and diseases of storage. This problem was proving to be of considerable economic importance.

All the above papers, together with five others, four being on storage problems and one on soil and manuring as affecting fruit production, will be published in full by the Imperial Bureau of Fruit Production as Proceedings of the Conference.

ON July 17 to 20, a conference of members of Rural Community Councils and others interested in the amelioration of rural life took place at Queen's College, Oxford. Everyone in the countryside now knows something of the excellent work the Rural Community Councils are doing in the counties privileged to possess them. There are now about 20 in Great Britain, the activities of each extending over the county whose name it takes. They are scattered from the County of Angus

**Rural
Community
Councils
Conference**

in Scotland to Kent and Somerset in England, though the northern part of England is not at present represented.

The Rt. Hon. Arthur Greenwood, M.P., Minister of Health, who attended an evening session of the Conference, gave an address which covered in the widest way the work and duties of these councils, and, looking ahead, advised them that their services would become much needed in the counties as voluntary helpers working side by side with the local authorities. At another session of the Conference, the rural housing problem came up for consideration, and it was clear from the discussion that the councils are anxious that the new houses and cottages put up in the country should be artistically suited to their environment and should harmonize with the older styles of dwellings found in each district. The necessity for the provision of proper house drainage—the septic tank where better cannot be obtained—and for the provision of a sound and pure water supply were matters also recognized as fundamental in making the countryside really fit for the habitation of its present and future citizens.

The question of co-operation in rural life, from the business and agricultural points of view, was dealt with by Sir Thomas Middleton, who stressed the need for closer business relationships for marketing purposes between our individualist British farmers. In the course of his remarks Sir Thos. Middleton said that the farmer's interests were at present centred in the market-place rather than on the farm. It was sale, not production, that caused him anxiety. The first stages of progress in collective action were likely to be along the lines of commodity marketing groups. Still marketing was, after all, only one side of the subject; though uppermost in our thoughts at the moment it was, he believed, the lesser of two difficulties which collective action might be called upon to face. The greater of the problems confronting the British producer was, to adopt current phraseology, the rationalizing of production.

There had been in recent times a large increase in the sale of fresh milk. This was good for the farmer and good for the consumer. We ought to use much more fresh milk; but, as he had already observed, the farmer was finding that the nation is easily satisfied. Concurrently with increase in production in the former milk-selling districts, there had come supplies from new districts rendered accessible by motor vans. These districts were the breeding grounds of store cattle; but milk brings money in a month, reared calves do not, and the result is that the milk goes to towns and the

calves somewhere. From that "somewhere" they may emerge as veal and ham or even as chicken paste, but certainly not as store cattle. Now a scarcity of store cattle reduces cattle feeding, and with it our root crops; a well-grown, well-manured root crop was still the backbone of our arable farming; the motor van reaching to the upland farm thus reacted on our tillage districts already depressed. As more tillage farmers attempt milk production the difficulties grow; for though Britain as a consuming country can draw upon the world, its farmer producers are interdependent save for the live stock bred in Ireland.

American farmers, already largely organized on a co-operative basis, had, so far as he knew, not yet heard of compulsion. The U.S. Government hoped that the necessary collective action could be obtained through co-operative organization; we must watch this situation with interest. Meantime what of our own country where co-operation had made far less progress? He asked if it were possible to secure the desirable degree of collective action by co-operative methods alone, or must there be compulsion of minorities? Both in England and Scotland agricultural opinion was divided. The experiences of those promoting the Milk Agency and the Potato Pool in Scotland strongly suggested that without compulsion success is not possible. The evidence of the need in England was less definite at the moment; but in agricultural affairs there was some justification for the belief that where Scotland is to-day England will be to-morrow.

Sir Thomas thought he could answer for the majority of farmers when he said that compulsion was an idea they disliked intensely, but if it was required to benefit the industry, it was an idea they must be contented to accept. It was, as he had already claimed, through freedom of individual action that our agricultural industry gained its high place. Nor could there be any doubt that the compulsion of minorities would at times restrict the enterprise and skill of individuals; but hard cases must be ignored if a large majority of the producers of a particular commodity were satisfied that they were suffering injury through the action of a minority; and the case against compulsion was far less likely to be supported by the progressive individual, who could almost certainly do better for himself than could a co-operative society, than by the mean person who tried to get the better of his fellows.

Family traditions and personal experience combined to make him an individualist, but it seemed to him that we

must be careful not to be led away too easily by the "freedom" argument. He preferred to approach this new policy in the attitude which his own first Parliamentary Chief, a great landowner and a great gentleman, always adopted to the tenants on his estate. His estate rule ran something like this: "Pray where you like, vote how you like, grow what you like, sell what you like, shoot what ground game you like, do what you like, so long as you do not hurt your neighbour." This, the policy which made the late Marquis of Lincolnshire a model exponent of co-operation in rural life, seemed to him to give sound guidance; and, if we accepted it, there were precedents enough for the laws which compel a man not to hurt his neighbour. Were there not cases, too, known to us, where market trespass might cause more injury than cattle trespass, or the trespass of thistle-down?

Many other subjects of interest to rural social workers were dealt with at the Conference. They included county organization in town and country, voluntary work in health services, music and the drama in the countryside, and the wide, almost all-embracing one, of education for country life. The last subject was discussed on the paper by Professor J. Scott Watson, Oxford, whose work in the field of rural social service is so widely known and appreciated. Sir Horace Plunkett attended several sessions of the Conference, and gave his blessing to it in a notable speech on the evening when, in recognition of the help which the Ministry of Agriculture had given to the movement, Sir Charles Howell Thomas, the Ministry's Permanent Secretary, was the guest of the Conference. Sir Charles told the Conference how much the Ministry appreciated the work of the councils in helping forward the improvement of rural conditions, a matter which the Ministry has very much at heart. The briefest account of the Conference would be incomplete without a tribute to the inspiration and guidance given by Professor Adams, its Chairman, who also presides over the parent body of the Rural Community Councils, the National Council of Social Service.

THE VALUE OF WHOLE MILK AND SEPARATED MILK FOR PIG FEEDING

CHAS. CROWTHER, M.A., Ph.D.,
Harper Adams Agricultural College.

[In 1928 the Ministry consulted with representatives of interested agricultural colleges and institutes as to the state of our knowledge of the value of whole milk and separated milk for the production of both pork and bacon. The result of the discussion was a general agreement that further inquiries were desirable, preferably of a co-operative nature.

A scheme of co-operative experiments was accordingly devised, and has since been carried out at four centres—the Harper Adams Agricultural College, the Midland Agricultural College, the Monmouthshire Farm Institute, and the Hampshire Farm Institute. The following report on the combined results of those experiments has been prepared by Dr. Charles Crowther.]

IN recent years the problem of the disposal of surplus milk has periodically compelled the serious attention of dairy farmers, and emphasized the need for reliable guidance as to the economics of various alternative methods of disposal on the farm. Of these alternatives, the most familiar are butter-making combined with calf-rearing on separated milk, and cheese-making combined with the feeding of whey to pigs. On both these systems a considerable amount of useful information is already available, and it is usually not difficult to give reliable advice as to their economic possibilities. On many dairy farms, however, for various reasons neither of these systems can conveniently be adopted in its entirety. In some cases, although cream- or butter-production might be practicable, the disposal of the skim or separated milk by calf-rearing is not feasible, whilst in other cases the solution can only lie in some system of direct utilization of the surplus whole milk as such. For such farms, the feeding of whole or separated milk to pigs offers a possible solution, and reports have appeared from time to time in the agricultural Press of apparently profitable experiences in this direction. The information available, however, is conflicting, and indeed very meagre in so far as evidence from carefully controlled experiments is concerned. The practical importance of the problem made it obviously desirable that some authoritative guidance should be obtained, and, as the outcome of a conference of representatives of agricultural colleges and institutes held at

the Ministry of Agriculture on April 27, 1928, a scheme of experiments was drafted which has subsequently been tested at four centres, with results which are summarized below.

The scheme was designed to suit more particularly the case of the average farm, on which pig-keeping could only be undertaken to a moderate extent and under simple conditions of feeding. For these reasons a standard allowance of $\frac{1}{2}$ gal. of milk per head per day was adopted throughout, to be fed along with a mixture of one-third sharps and two-thirds barley meal. This plain cereal mixture was used as the "basal ration," rather than as a "balanced" mixture, as it was considered that the addition of milk would give an adequate "balance" and eliminate the necessity for the purchase of expensive balancing foods of the meat meal, etc., class.

The scheme of experiment was as follows :—

(1) **Selection and Number of Lots.**—At every centre where the experiment is undertaken, not less than two lots of pigs (hereinafter referred to as Lots A and B) shall be selected, but it shall be optional for each experimenter to add one or two additional lots (hereinafter referred to as Lots C and D).

The desirable number of pigs to constitute each lot shall be regarded as 10, and in no case shall the number be less than 8 per lot. The age of the pigs when selected shall be approximately 10 weeks, and in all other respects, e.g., size, breed, distribution of sex, the lots shall be as uniform as possible.

(2) **Treatment of Each Lot.**—In all respects, except in regard to the rations fed, the treatment and housing of the lots shall be as nearly as possible identical. It is not necessary—indeed it may not be desirable—that each lot shall be housed in one sty, but it is important that any division adopted shall be made to apply equally to each lot.

If worming of the pigs is thought necessary, it should be done before the commencement of the experiment.

(3) **Rations.**—*Lot A* shall, in all cases, be the Control, and shall be given a basal ration consisting of $\frac{1}{3}$ rd sharps and $\frac{2}{3}$ rds barley, per pig.

Lot B shall, in all cases, be fed with the basal ration fed to *Lot A*, plus $\frac{1}{2}$ gal. (reckoned as 5 lb.) of whole milk, per pig daily.

Lot C (optional) shall be fed with the basal ration plus extracted soya bean meal (12 per cent.).

Lot D (optional) shall be fed with the basal ration, plus $\frac{1}{2}$ gal. of separated milk.

Each lot shall receive also mineral mixture (two parts ground limestone, two parts steamed bone flour, one part salt) at the rate of 3 per cent. of the meal fed.

About 1 lb. per head of green-stuff must be given daily to each lot; a little small coal or ashes may be given occasionally, if desired.

A record shall be kept showing whether morning or evening milk has been fed. Where the milk has been pasteurized the temperature of pasteurization should be noted.

Immediately the lots have been selected they should be placed on the experimental rations for about a week before the actual commencement of the experiment, in order to give the pigs time to settle down.

(4) **Mode of Feeding.**—The meals shall be mixed with water at the rate of roughly 4 lb. of water per lb. of meal at the outset, the proportion being reduced periodically to about 3 : 1 at the end of the experiment. In the case of experimental Lots B and D, the milk should be mixed with the meals, and water added to give a similar consistency to that of Control Lot A.

Pigs shall be fed twice daily and given at each meal just as much of the prepared slop as they will clean up within the hour. The careful assessment of this quantity is an important factor in the success of the experiment. The periodic increases in the milk ration will be determined by the appetite of the pigs.

A careful record of food consumed must be kept. The slop should be prepared from day to day.

(5) **Weighing.**—At the end of the week immediately preceding the commencement of the experiment each pig shall be weighed on three consecutive mornings before feeding, the mean of the three weights to represent the weight at the commencement of the experiment, and the date of commencement to be taken as the second of the above three days.

The pigs shall then be weighed periodically, weekly if possible, on the same day of the week as the middle day of the three initial weighings. All weighings shall be made at the same time in the morning before feeding, and weights should be taken to the nearest $\frac{1}{4}$ lb.

(6) **Disposal of Pigs.**—Each pig shall be disposed of either for pork at or about the live weight of 100 lb. or 140 lb., or for bacon at or about the live weight of 220 lb., and the price obtained noted.

At each centre the pigs must either all go for pork or all for bacon. Where the pigs go for pork all should go either at or about 100 lb. or about 140 lb. and not some at the one weight and the rest at the other. Carcass weight (inclusive of head, feet and edible offal) as at 24 hours after slaughter must be ascertained to the nearest $\frac{1}{4}$ lb. for each pig. If weighed immediately following slaughter, a deduction of 5 per cent. must be made.

(7) **Deaths or Illness of Pigs during Experiment.**—In the event of any pigs dying during the experiment, a note of the date of death, and the undressed weight at time of death, should be taken and included in the records.

If it should be necessary, owing to illness, to remove a pig temporarily from a lot, the period of such removal, and the live weights on removal and on return, must be noted.

When from any cause the number of pigs in a lot is reduced the ration should be reduced in proportion.

(8) **Assessment of Results.**—(a) *Initial Value of Pig.*—If pigs are purchased, the actual cost should be taken. If reared, and cost records are not available, a standard value of 27s. for 10 weeks old pigs should be assumed. The basis adopted should be noted in the report.

(b) *Labour.*—2d. per week per pig should be charged.

(c) *Cost of Meals.*—This should be returned at cost on the farm.

(9) **Report on Experiment.**—Each centre shall furnish the Ministry with a report at the end of the experiment. These reports will be referred to Dr. Crowther, who will prepare a report on the combined results.

Experiments in accordance with the foregoing scheme have been carried out at the following centres :—

Harper Adams Agricultural College (Dr. C. Crowther and Mr. J. Fullerton), four lots (A, B, C, D).

Midland Agricultural College (Mr. H. G. Robinson), three lots (A, B, C).

Hampshire Farm Institute, Sparsholt (Mr. J. M. Templeton), three lots (A, B, D).

Monmouthshire Agricultural Institution, Usk (Mr. G. H. Purvis), three lots (A, B, D).

In the Monmouthshire Test the pigs were sold as porkers, whereas in the other three cases they went out at bacon weights. The initial weights differed considerably, however, at these three centres, the average per pig being roughly 38 lb. at Harper Adams College, 82 lb. at Sparsholt, and 95 lb. at the Midland College. This factor will obviously need to be taken into account in comparing the results. There were differences also in the type of pig used, as will appear in the reports on the various tests.

In order to assess the values realized for the whole milk and separated milk respectively, the cost of the sharps, barley and minerals consumed and of the labour (taken at 2d. per pig per week) is deducted from the total receipts for the pigs when sold. All other costs, including initial value of pigs, are the same for each lot and therefore need not be considered.

From the balance over "cost" thus arrived at any balance obtained in the same way with the Control Lot (Lot A) is deducted, and the final figure thus obtained represents the value realized for the quantity of milk consumed.

Monmouthshire Test.—In this test, carried out in June and July, 1928, three lots of eight pigs each (six Middle White and two Large Black x Large White) were used, the pigs being drawn from four litters, differing in age by 20 days. The average age at the commencement of the experiment was 11 weeks, and the pigs were then valued at 25s. each. All the pigs were disposed of locally for pork, the carcass weight being taken 24 hours after slaughter. The average period of feeding was 64 days in the case of each lot.

The feeding and management of the three lots was exactly in accordance with that provided for Lots A, B and D of the standard scheme, i.e., Control Lot, Whole Milk Lot and Separated Milk Lot. The weight of meals fed to each lot was the same, the average cost of the mixture being £10 12s. 7d. per ton. All the milk fed was morning milk, given in perfectly fresh condition. The price realized on sale was 9d. per lb. dressed carcass weight (= 15s. per score lb.).

The essential features of the results are summarized below:—

	<i>Lot A</i> (Control)	<i>Lot B</i> (Whole milk)	<i>Lot D</i> (Separated milk)
Initial weight per pig (average) ..	45.5 lb.	44.6 lb.	43.5 lb.
Final live weight per pig (average) ..	94.4 "	124.3 "	115.5 "
Gain in live weight in 64 days ..	48.9 "	79.7 "	72.0 "
" " " average per day ..	0.76 "	1.24 "	1.13 "
Average carcass weight, as percentage of live weight ..	67.81 p.c.	73.64 p.c.	72.62 p.c.
Cost of meals fed, per pig ..	23s. 0½d.	23s. 0½d.	23s. 0½d.
Milk consumed, average per pig ..	—	31.75 gal.	31.75 gal.
Realized for pork, per pig ..	48s. 0d.	68s. 7½d.	62s. 11d.
Cost of labour, per pig ..	1s. 6½d.	1s. 6½d.	1s. 6½d.

SUMMARY

	s.	d.
<i>Lot A.</i> —Value realized, per pig	48	0
Cost of meals and labour	24	7
Balance, per pig	23	5
<i>Lot B.</i> —Value realized, per pig	68	7½
Cost of meals and labour (as above)	24	7
Balance, per pig	44	0½
Deduct balance obtained with <i>Lot A</i> (above) ..	23	5
Net return from 31.75 gal. whole milk	20	7½
Return per gallon of Whole Milk	7.79	4d.
<i>Lot D.</i> —Value realized, per pig	62	11
Cost of meals and labour (as above)	24	7
Balance, per pig	38	4
Deduct balance obtained with <i>Lot A</i> (above) ..	23	5
Net return from 31.75 gal. Separated Milk	14	11
Return per gallon of Separated Milk	5.63	4d.

In the separate report on this experiment the comment is made that "while the new milk pen made the greatest apparent progress early in the experiment, those pigs fed on the separated milk, although not attaining the "bloom" of the pigs in Pen B, produced rather firmer flesh with a better distribution of lean with fat."

Briefly summarized, the value realized in this experiment for the production of pork at 15s. per score, with a meal mixture at about £10 12s. per ton, was approximately 7½d. per gallon for whole milk and 5½d. per gallon for separated milk. These values will naturally vary proportionately with the price per lb., stone or score realized. Thus, at 16s. per score (the price taken in assessing the results of the other experiments) the values realized would have been one-fifteenth

higher, 8-31d. per gallon for whole milk and 6-01d. per gallon for separated milk.

It may be noted that Lot A, although not receiving milk, took only the same amount of food as the other two lots. One would have expected them to consume rather more, but the report on the experiment explicitly states that the pigs were given at each meal "just as much of the prepared slop as they could clean up within the hour."

It is of interest to note that in the Harper Adams experiment dealt with later the results obtained over a range of growth comparable with that of the Monmouthshire pigs agreed very closely with the latter, the average growth rates for the nine-week period being 0-70 lb., 1-22 lb. and 1-07 lb. per pig per day for Lots A, B and C respectively. These lead to almost precisely the same financial results as those given above.

Sparsholt Experiment.—In this experiment, carried out from November, 1928, to January, 1929, three lots (A, B and D) of eight pigs each were used. The pigs were all sired by the same Large White Boar, partly out of Large White sows and partly from Large Blacks.

The pigs are reported as averaging about 14 weeks old at the commencement of the experiment, but as the average live-weight at that stage was about 82 lb., a rather higher average age would seem probable.

The milk used was all from the morning milking and was fed in fresh, sweet condition. The price of the meal mixture used averaged £9 7s. 0d. per ton, no charge being made for grinding the barley.

The first draft of fat pigs was sold on December 27, comprising one pig from Lot A, four pigs from Lot B and three pigs from Lot D. The remaining pigs from Lots B and D, and one pig from Lot A, were sold on January 14, 1929. A third pig from Lot A was sold on January 28 and a fourth on February 14, but the remainder were barely up to the prescribed bacon weights on March 21, the date of the last weighing recorded. In this connexion Mr. Templeton remarks that "the health of all the pigs was good throughout, but when the extreme cold set in in January those pigs remaining in Lot A made very slow progress. . . . Owing to the severe weather experienced in January and February, I would suggest that the experiment be terminated at the end of the twelfth week, viz., January 11." At that period, Lots B and D were all cleared up and therefore did not experience the severe weather which accompanied the finishing stages of the pigs in Lot A.

This suggestion has the disadvantage of necessitating a valuation of the pigs in Lot A which remained unsold on January 11, but it would seem to be the best solution of the difficulty, and has been adopted below in assessing the results.

The selling price of the pigs varied considerably, but 16s. per score dead weight may be taken as the average price realized.

The essential features of the results are summarized below:—

	<i>Lot A</i> (Control)	<i>Lot B</i> (Whole milk)	<i>Lot D</i> (Separated milk)
Average feeding period per pig, days	82.2	78.75	80.5
Initial live weight per pig (average)	77.75 lb.	85.75 lb.	81.75 lb.
Final live weight per pig (average)	166.62 „	219.5 „	212.0 „
Average gain in live weight per day	1.08 „	1.70 „	1.62 „
Average carcass weight	116.4 „	160.75 „	155.25 „
Cost of meals fed, per pig	39s. 5½d.	38s. 10½d.	39s. 3½d.
Milk consumed, per pig	—	39.25 gal.	40.3 gal.
Final value for bacon, per pig, at 16s.			
per score	93s. 1½d.	128s. 7d.	124s. 2½d.
Cost of labour, per pig	1s. 11½d.	1s. 10½d.	1s. 11d.

SUMMARY

	s.	d.
<i>Lot A.</i> —Final value, per pig*	93	1½
Cost of meals and labour	41	5
Balance, per pig	51	8½
<i>Lot B.</i> —Value realized, per pig	128	7
Cost of meals and labour	40	9
Balance, per pig	87	10
Deduct balance obtained with meals, <i>Lot A</i> (above)	51	8½
Net return from 39½ gal. Whole Milk	36	1½
Return per gallon of Whole Milk	11	1d.
<i>Lot D.</i> —Value realized, per pig	124	2½
Cost of meals and labour	41	2½
Balance, per pig	83	0
Deduct balance obtained with meals, <i>Lot A</i> (above)	51	8½
Net return from 40.3 gal. Separated Milk	31	3½
Return per gallon Separated Milk	9	3d.

* For *Lot A*, two pigs taken at actual carcass weights, rest at estimated carcass weights taken from standard live and dead weight table of East Anglian Pig Recording Scheme.

In considering the results of this experiment it must be remembered that they are affected by an element of uncertainty, owing to most of the pigs of *Lot A* not having been finished and sold by the date taken as the close of the experiment. The degree of reliability of the estimate of the final value of these pigs cannot be checked, but the error, if any, is probably

only small and unlikely to affect the final results for the value of the milk by more than about $\frac{1}{2}$ d. per gallon either way.

On comparing the initial live weights of the individual pigs, Lot B (Whole Milk) would seem to have started with a little advantage, and Lot A (Control) with a little disadvantage from the point of view of uniformity. The range of variation amongst the individual pigs is shown below.

		<i>Initial Live Weights</i>	
		<i>Average.</i>	<i>Range of Variation.</i>
		lb.	lb. lb.
Lot A ..	..	77.75	59-104
Lot B ..	..	85.75	77-103
Lot D ..	..	81.75	66-98

The tendency of these inequalities would be to exaggerate slightly the final results for the milk values realized.

Midland College Experiment.—In this experiment, carried out, May to August, 1928, three lots (A, B and C) of eight pigs each were used. The pigs were from Middle White sows by a Tamworth boar, and averaged about 95 lb. live weight each at the start of the experiment, with an extreme range from 77 lb. to 117 lb. The whole milk used for Lot B contained on the average about 3.6 per cent. of fat, and was fed in sweet condition.

Details of the experiment were in accordance with the standard scheme, Lot A receiving the Control ration, Lot B the Control ration plus Whole Milk, and Lot C the Control ration plus Extracted Soya Meal.

The pigs were sold at a uniform price of 16s. per score dead weight. There was no significant difference in average carcass percentage between the three groups.

The essential features of the results are summarized below:—

	<i>Lot A</i>	<i>Lot B</i>	<i>Lot C</i>
Average feeding period, per pig, days	85.5	80.1	82
Initial live weight, per pig (average)	94.4 lb.	93.8 lb.	96.9 lb.
Final live weight, per pig (average)	214.3 ..	226.3 ..	208.8 ..
Average gain in live weight, per day	1.40 ..	1.65 ..	1.36 ..
Average carcass weight	160.4 ..	168.1 ..	154.2 ..
Cost of meals fed, per pig	40s. 7d.	39s. 7d.	40s. 3½d.
Milk consumed, per pig	—	40.06 gal.	—
Weight of soya meal consumed by			
Lot C, average, per pig	—	—	41.2
Realized, per pig	128s. 3½d.	134s. 6d.	123s. 4½d.
Cost of labour, per pig	2s. 0½d.	1s. 11d.	1s. 11½d.

SUMMARY

				s.	d.
<i>Lot A.</i> —Value realized, per pig .. ..	..	..	..	128	3½
Cost of meals and labour .. ..	..	..	..	42	7½
Balance, per pig .. ..	..	..	..	85	8

	s.	d.
<i>Lot B.</i> —Value realized, per pig	134	6
Cost of meals and labour	41	6
Balance, per pig	93	0
Deduct balance obtained with meals alone (<i>Lot A</i>)	85	8
Net return from 40.06 gal. Whole Milk ..	7	4
Return, per gallon, Whole Milk	2	19d.
<i>Lot C.</i> —Value realized, per pig	123	4½
Cost (barley, sharps, minerals and labour) ..	37	5½
Balance, per pig	85	11½
Deduct balance obtained without Soya Meal	85	8
Net return from 41.2 lb. Soya Meal	0	3½
Return, per cwt. of Soya Meal	8	8d.

The results of this experiment are in very sharp contrast to those of the Sparsholt experiment, to which it is closely comparable as regards the initial weight of the pigs and the length of the feeding period. This is accounted for by the surprisingly high rate of growth registered by *Lot A*. In the writer's experience it is very rare, over the range of feeding here in question (90-220 lb. live weight), to secure an average growth-rate appreciably higher than 1.0 lb. per day on a ration of barley meal, sharps and minerals. It will be noted that in the Sparsholt experiment the average gain per day for the Control Lot was 1.08 lb. and in the Harper Adams experiment over a comparable period the average was 1.05 lb. per day. We can hardly resist the conclusion, therefore, that in the Midland College experiment some abnormal factor must have been operative in the case of *Lot A*, which has defeated the object of ascertaining a reliable figure for the value of the whole milk fed to *Lot B*. The explanation may possibly lie in the fact that up to the start of the experiment all the pigs had been receiving separated milk and whey along with a balanced ration of meals, including soya meal. It is not unlikely that a preliminary benefit was thereby secured, the effects of which persisted throughout the subsequent feeding period. This view receives some support from the close resemblance between the performances of *Lots A* and *C*, and deserves further study.

Harper Adams College Experiment.—In this experiment, the most comprehensive of the series, all the four lots of the standard scheme were included, and the feeding period was more prolonged owing to the lower initial weights at which the experiment was started.

The pigs used, 10 per lot, were all Large Whites bred at the

Experimental Station, and averaged about 12 weeks old at the start. The pigs in each lot showed a rather considerable range in initial weight, but the following data indicate that the lots were fairly well matched in this respect.

						<i>Live weight per pig</i>		
						<i>Average.</i>	<i>Range.</i>	
						lb.	lb.	lb.
Lot A	..	..	..	..	..	37.43	23	52½
Lot B	..	..	..	..	..	38.30	23½	55½
Lot C	..	..	..	..	..	37.57	27½	50
Lot D	..	..	..	..	..	37.50	28½	50

All details of feeding and management were strictly in accordance with the standard scheme. The whole milk and separated milk used came from the morning milking, and were fed in fresh condition.

The experiment commenced on July 17, 1928, and was continued for 28 weeks, at the end of which time all the pigs in Lot C had been sold, four pigs from Lot A, nine pigs from Lot B and eight pigs from Lot D. In calculating the results the values of the nine pigs remaining unsold at the close of the experiment have been assessed on the basis of the standard table of live and dead weights of the East Anglian Pig Recording Scheme.

As was to be expected, the pigs of Lot A lagged behind the rest from the start, but for some reason which could not be diagnosed the two milk lots (B and D) did not make quite the rate of growth which was expected, as the long duration of the experiment clearly indicates. In order to simplify marketing some of the pigs were brought to appreciably higher weights than the 220 lb. suggested in the standard scheme. The prices realized per score varied somewhat, but an average price of 16s. per score has been taken in the following tables.

The essential features of the results are summarized below:—

	<i>Lot A</i>	<i>Lot B</i>	<i>Lot C</i>	<i>Lot D</i>
Aver. feeding period, per pig, days	196	168	189	180.6
Initial live wt., aver., per pig	37.43 lb.	38.3 lb.	37.57 lb.	37.6 lb.
Final live wt., aver., pr. pig	208.82 ..	248.32 ..	252.37 ..	230.68 ..
Aver. gain in live wt., pr. day	0.88 ..	1.25 ..	1.14 ..	1.07 ..
Average carcass weight..	150.9 ..	188.4 ..	192.4 ..	183.6 ..
Cost of basal ration, pr. pig	79s. 7d.	63s. 4d.	78s. 8d.	73s. 6d.
Milk consumed, per pig..	—	83.75 gal.	—	91.45 gal.
Wt. of soya meal consumed by Lot C, aver., pr. pig	—	—	97.65 lb.	—
Realized, per pig ..	120s. 9d.	150s. 9d.	153s. 11d.	146s. 11d.
Cost of labour, per pig..	4s. 8d.	4s. 0d.	4s. 6d.	4s. 4d.

SUMMARY

					s.	d.
<i>Lot A.</i> —Value realized, per pig ..	..	..	..	..	120	9
Cost of meals and labour ..	..	..	..	..	84	3
Balance, per pig ..	..	..	..	..	36	6
<i>Lot B.</i> —Value realized, per pig ..	..	..	..	..	150	9
Cost of meals and labour ..	..	..	..	..	67	4
Balance, per pig ..	..	..	..	..	83	5
Deduct balance obtained with meals alone (Lot A) ..					36	6
Net return for 83·75 gal. Whole Milk ..	..	..	..	..	46	11
Return per gallon Whole Milk ..	..	..	..	..	6·72d.	
<i>Lot C.</i> Value realized, per pig ..	..	..	..	..	153	11
Cost (basal ration and labour) ..	..	..	..	..	83	2
Balance, per pig ..	..	..	..	..	70	9
Deduct balance obtained without Soya Meal (Lot A)					36	6
Net return from 97·65 lb. Soya Meal ..	..	..	..	..	34	3
Return per cwt. Soya Meal ..	..	..	..	..	39	3
<i>Lot D.</i> —Value realized, per pig ..	..	..	..	..	146	11
Cost of meals and labour ..	..	..	..	..	77	10
Balance, per pig ..	..	..	..	..	69	1
Deduct balance obtained with meals alone (Lot A) ..					36	6
Net return for 91·45 gal. Separated Milk ..	..	..	..	..	32	7
Return, per gallon Separated Milk ..	..	..	..	..	4·28d.	

The returns both for whole milk and for separated milk come out much lower in this experiment than in the Sparsholt experiment, but this is explained by the much lower rate of growth. It should be remembered also that the Harper Adams experiment covered a much longer period of growth, the average weights per pig being lower at the start and higher at the finish than in the Sparsholt experiment. For the period of growth comparable with that covered by the latter the average daily gains in live weight (per pig) were 1·35 lb. in Lot B and 1·18 lb. in Lot D. Both experiments agree, however, in indicating that the value per gallon realizable with separated milk falls but little short of that realizable with whole milk, a conclusion with which also the Monmouthshire pork production figures are in harmony.

The soya meal in the Harper Adams experiment (cost £10 16s. 0d. per ton) showed a very handsome profit.

Summary.—The results of the four experiments here summarized will effectively dispose of any idea that for any given combination of food prices and carcass values it is possible to give a fixed value to either whole or separated milk for pig-feeding, since the return is so greatly influenced by the rate of growth obtained, this varying with the type of pig, housing, management and other necessarily variable factors.

This is well illustrated in the results of the Sparsholt and Harper Adams experiments, the two most nearly comparable experiments of the series. In the former, with an average growth-rate of 1.70 lb. per day, the return per gallon of whole milk was 11.1d. per day; and with separated milk a return of 9.3d. per gallon on an average growth-rate of 1.62 lb. per day. In the Harper Adams experiment, over the same range of growth the average growth-rates secured were only 1.35 lb. and 1.18 lb. respectively, resulting in the correspondingly lower returns per gallon of 6.7d. for whole milk and 4.3d. for separated milk. These latter results can perhaps be regarded as minima, since the growth-rates are certainly below those commonly attained in milk feeding.

For reasons given above the Midland College experiment must be regarded as abnormal, and can hardly be brought into comparison with the rest.

As far as bacon production is concerned, therefore, under the conditions of the experiment, with a cereal ration costing in round figures 10s. per cwt., and bacon pigs realizing about 16s. per score dead weight, a return of from 7d. to 11d. per gallon for whole milk, and of 4½d. to 9d. per gallon for separated milk, may be expected, the actual value realized between these limits turning primarily upon the rate of growth secured. The range of variation indicated is unfortunately too great to furnish any very definite practical guidance, but it can only be defined more narrowly by repetition of the experiments on a greatly extended scale.

The Monmouthshire experiments, being restricted to pork production, stand alone in the series and cannot be compared directly with the rest, but it is of interest to note that the results fall intermediately within the range above indicated, and thus harmonize with the general conclusion drawn, as do the Harper Adams figures for the same range of growth.

AGRICULTURAL EDUCATION IN CHESHIRE :

A TEN YEARS' RETROSPECT

W. B. MERCER, M.C., B.Sc., N.D.A.,

*Principal, Cheshire School of Agriculture, Reaseheath,
and Agricultural Organizer for Cheshire.*

*" each in his separate star,
Shall draw the thing as he sees it,
For the God of things as they are."*

THE Cheshire School of Agriculture owes its inception in part to historical considerations and in part to the stimulus of the farm institute campaign with which the name of Sir Daniel Hall is associated. Agricultural education has had rather a long history in Cheshire, thanks to the activities of local landowners and other public-spirited people ; there was a school of dairying at Worleston before the passing of the Local Government Act in 1889, and the County Council, ever since its formation, has devoted unremitting attention to the subject. Under the Council's ægis, Worleston was enlarged and an institution which grew into Holmes Chapel Agricultural College was founded. Other public bodies, notably the Chamber of Agriculture and the Cheshire Milk Producers' Association, had also interested themselves in educational measures. Various considerations dictated a new campaign at the end of the War, for Holmes Chapel had not survived the withdrawal of students for War service ; Worleston was becoming out of date in buildings and equipment, and other activities were felt to be too scattered.

In 1918, on the death of the owner, the Reaseheath estate was offered to the authority, and proved on examination to be singularly suitable for the purpose in view, comprising a country mansion standing in beautiful grounds, with a home farm of more than 200 acres, extensive outbuildings suitable for conversion into laboratories and classrooms, a small detached farm and a hamlet containing 14 cottages, the whole situated in the heart of the dairying area, and readily accessible either by road or rail. It was, therefore, purchased and its development proceeded with ; male students being admitted from 1921 onwards.

Experience at Worleston had shown that there was an all-the-year-round demand for dairying instruction—the demand being, indeed, heaviest in the winter time—so that a

scheme which provided for men only in the winter and women only in the summer would not be satisfactory. Provision for co-education was inevitable, if the desired concentration of effort was to be achieved. Owing to various causes, chief among which were financial considerations, it was not possible to proceed with the buildings necessary to accommodate women students for some years ; but eventually a hostel and a large teaching dairy were erected, the farm buildings were remodelled and the institution, now fully established, was opened by H.R.H. The Prince of Wales in the autumn of 1926.

Development thus occupied a period of seven years, or, if the first three years of completed life be reckoned as an experimental period, of ten years in all. The main lines upon which development must proceed were evident from the commencement, but as the gradual development has allowed of constant review and reconsideration of original conceptions, in the light of experience gained, it seems opportune at this point to offer a few general observations on county agricultural education.

The Purpose of a County Centre.—The purpose of a county centre may be defined broadly as that of furthering the industry by educational means.

Fundamentally its duties towards resident students and towards farmers are the same, although the means whereby these functions are performed—teaching and advisory work respectively—are necessarily different. Both hang ultimately on the extent to which the central institution functions as an intellectual centre. The mere facts disseminated have, of course, considerable value, particularly in the case of students ; but, even in this case, it has to be recognized that many of these facts could equally well be acquired elsewhere—many of them are, indeed, regularly handed on from father to son on good farms. What is of much greater importance is the cultivation, both in students and in practical farmers, of a scientific outlook—an outlook which insists on precision, orderly arrangement of facts, and logical deduction therefrom : an outlook which regards knowledge as an end in itself. The agricultural world is based on a theory and practice of life which consists of work and sleep—from which conception, incidentally, nearly all our economic difficulties spring. The fundamental business of an educational centre is to create an atmosphere, to invest labour with the glamour of intellectual treatment, to subject practice to scientific analysis.

The Aim of the Trading Departments.—To elaborate this theme it is necessary—or, at any rate, helpful—to turn to the farm, or to some other trading unit, since from this the institution as a whole will take its tone. The policy of the farm will dictate the nature of the teaching and of the advisory work. We assume at the outset that the students—or, at all events, a goodly proportion of them—will be either sons of farmers, or young people taking up practical work on the farm for a livelihood. In the past, the question of their education has been discussed chiefly from the viewpoint of what they may be considered to need. It is more helpful, however, to a teacher to consider it from the viewpoint of what he is in a position to teach them—to ask himself what special advantages, if any, he has over other farmers who for generations untold have brought up their sons and daughters in the ways of agriculture !

Farm Management.—The answer depends very much on his attitude to the farm. The ideal to be aimed at is a farm in the management of which every material fact established by science is utilized, and from which every material economic fact can be gained. This implies a clear-cut purpose in every step taken, careful and laborious recording of results, and a fearless facing of the facts when collected. Common honesty and courage are among the first attributes of a teacher, for it should be observed that failures are bound to come. No scientific worker expects all his experiments to “come off.” Klebahn used to tell his students that he was content if 10 per cent. of his experiments were successful. Unfortunately for us, our work has to be performed beneath the gaze of a public which demands a nut for every shy. It is so pitifully easy for critics to hold up to scorn unsuccessful efforts, to dismiss them sweepingly as due to “mismanagement.” Rightly used “failures” may prove more valuable than successes : but it requires some courage to own to them at all.

If one reviews a farming year and all the operations contemplated, it is gratifying—at any rate to anyone with personal associations in agricultural education—to see at how many points agricultural science and practice make contact. To the scores of questions which arise in the course of a year’s work, some answer at any rate is to be found in the pages of recorded research or experiment—often the evidence is imperfect, but there is evidence of some sort. Oddly balanced, however, one finds the volume of the book is here a wealth

of information on some point of relatively little economic consequence, there a yawning gap. On Reaseheath farm, about £100 a year is spent on artificial manures, and literature to guide one in the spending of that sum pours in in a steady tide to join the sea already accumulated; meantime, one searches literature in vain for experimental evidence which will tell one how to rear dairy cattle or to dispel that shadow of disease which broods perpetually over every stock farm.

Much of the information needs checking, or adding to, by local trials, but take it for all in all, it amounts to a goodly heritage.

Parenthetically, one gains from such a review a wholesome respect for empirical work; and one rises with the prayer that some day funds, commensurate with our needs, will be available for investigations on animal diseases.

When, however, one turns from consideration of the programme projected to that of the probable financial results, one is in a very different position. Agricultural science can contribute nothing beyond the scanty conclusions on internal economics derived from surveys and cost accounting, and the general principles set forth in text books and market reports concerning the larger or external issues. As regards information, the teacher is no better off than every other farmer—indeed, he is generally not so well off, for farmers have the traditional knowledge of their area which, even if unreliable, is better than nothing.

Towards the economic issues, therefore, but one attitude is possible—that of the student. One must be content to learn as one goes; to set a course, using such guides and landmarks as one has, adhere as far as may be to it, record the results faithfully, be they good or bad, and endeavour to learn therefrom. In so doing, one is but following those trial-and-error methods by which practically all human progress has been achieved, and if scientific precedent be sought, is it not found in the use of the working hypothesis?

Cost accounting is valuable as a check; indeed, economic study, whether internal, or external, is impossible without such aid. It is subject, however, to many limitations. Crude conventions in allocation of charges become absorbed into a system, and with usage tend to become accepted as facts; the whole principle of allocation of labour at fixed charges per hour or per day is of doubtful applicability to a stock farm. It is impossible, for instance, to give mathematical value to a good stockman's service. Is it not traditional that

the master's eye fattens cattle? On a teaching farm, it is difficult to give due weight to such abnormal charges as management, demonstration costs, and so on. All these facts notwithstanding, cost accounting is one of the first requisites in a study of the economy of the farm.

Of even greater consequence are the field and stock records used in cost accounting. British agriculture is sadly lacking in reliable statistics; few farms have the means of making records. For many years to come almost any records of performance which can be taken on a farm—be they yields of crops, rates of growth, numbers of progeny, incidence of disease, or what not—will be of value both on the farms where they are made and as material for study of principles. Agricultural science in the past has relied almost entirely on the experimental method of pursuing inquiries; we are in danger of forgetting that another equally reliable method, the statistical, is open to us.

One must be prepared, by such methods, to reach conclusions somewhat at variance with those of controlled experiments. In controlled experiments, every effort is made to rule out disturbing factors in order that the effect of the factor under study may be revealed; in consequence the result, though true for those particular circumstances, may not be obtainable in practice. It is a relative result. In practice it is only the absolute result which counts. Thus, everyone takes small groups of selected pigs for feeding trials; but, working in practice with large groups of mixed animals, it is futile to look for the same absolute results, although the relative results may be similar. The gospel of the average has to be learned and relearned in practice.

Again, one is likely to discover by such methods unsuspected gaps in our armour. Much attention has been given to feeding of dairy cows and to milk records; from the evidence of scientific works the conclusion seems irresistible that the high-yielding cow is the most profitable. Again, however, the evidence is imperfect. It is not possible to discuss an economic question of this kind without consideration of the sale price of milk, capital cost of the cow, rate of depreciation and so forth. In some circumstances the handsome, high-yielding cow is an expensive luxury.

One writes of the ideal to be aimed at on the farm; it is not to be supposed that this ideal can in fact be attained. There are conflicting factors. It is difficult entirely to escape the "show" farm atmosphere. What man who loves the land

and all its works can resist the temptation to grow "something for folks to see"; who that lives much amongst livestock can subordinate all æsthetic sense to economics? In addition, personal aspects apart, there is always the propaganda side to consider. There are hosts of men, good solid farmers, too, who will be more impressed by a big wheat crop or a fine-looking herd of cattle than by the most erudite teaching. A sop to Cerberus seems justifiable. One of the first principles in teaching is to get oneself listened to. Even St. Paul, greatest of teachers, recognized the claims of expediency. A reasonably high standard of production is, in any event, forced upon one; a strictly commercial outlook on, say, clean milk production is unthinkable, even if the milk be used for cheesemaking.

On the vexed question of the net financial results of working the farm, it is difficult to write with confidence. That it is possible to run a farm to advantage educationally, and at the same time to show a net profit on the year's working, cannot be doubted, but whether any particular purpose is served thereby is another matter. The main purpose of the farm is information. The net financial results will obviously depend on existing market conditions for the main products; and one cannot limit the undertakings of a farm by the market conditions which happen to prevail in the particular area in which it is situated. Common sense and public duty alike suggest, however, that net deficits should be kept within reasonable limits.

The case of the farm has been discussed at length as it is much the largest trading section; but the principles set forth apply equally in all departments.

Students.—To turn next to the numbers and types of students applying for admission, an examination of the figures to date affords some explanation of the organization for teaching which has been adopted.

Cheshire is a county of small farms, worked in the main by family labour. It has been given over to dairy farming from time immemorial, although, with the rise of the great markets in Lancashire, potato growing has in modern times become a feature of the agriculture of the northern half. Children commence work at an early age, and, on leaving school, are immediately absorbed into the farm routine. Of late years, the size of the family, as everywhere else in England, has fallen considerably. There is a steady influx into the area of young men and women from the towns with or without capital. There can be no question that the demand for young men

to replace non-existent sons is growing and will grow. Cheese-making, though slowly declining, still offers an immense market for skilled work. Poultry keeping is visibly increasing. A liberal scheme of scholarships, offering residence and tuition free of cost or at reduced fees, is in existence. As a result of all these factors, one finds that there is a demand for special training in dairying, poultry keeping and horticulture, in addition to that for general agriculture. It has been necessary, therefore, to organize special courses of instruction in these subjects—an arrangement which happens to coincide with and justify commercial organization of four separate and semi-autonomous departments.

Attendances to date have been as follows (the figures for men being for 7 years, and those for women for 3 years only) :—

	<i>Farmers' Sons</i>	<i>Farmers' Daughters</i>	<i>Other Males</i>	<i>Other Females</i>
Agriculture	72	—	115	—
Dairying	23	28	43	71
Poultry Keeping ..	3	1	44	20
Horticulture	5	—	28	7

The subsequent histories of students are not definitely known, but everyone has entered with the professed intention of taking up some form of practical agricultural work, and the vast majority are certainly so employed now. It cannot be doubted that the fruits of education are being carried to the land, but it is noteworthy that the majority of students are carrying them in the capacity of employees rather than of employers or potential employers. Such a result is natural enough in the case of the three "specialist" courses, and, as far as it goes, is a good sign; it means that education has a market value. The case of the agriculture course is different. At a liberal estimate, the proportion of farmers' children who have attended cannot amount to more than 5 per cent. of those who have in this period been of suitable age. To conclude that the farmers approve of education for their employees, but not for their own children, would be, as Dr. Crowther puts it, "pure nonsense." Some other explanation must be sought; and there would seem to be three possibilities.

(1) Unpleasant as it may be to write it, it is possible that farmers "have no use" for educationists and all their works. The evidence to the contrary—particularly the attitude of those farmers who have sent children in the past, and of the great number who, through advisory and other means, are known personally to the staff—is so overwhelmingly against this view that it can with confidence be dismissed.

(2) It is possible that, reared within the narrow round of a small farm, with no education beyond that of the elementary school, youths and girls fight shy of a residential institution. Unquestionably, this accounts in part for many absences.

(3) A third cause remains—the value of a son's or a daughter's labour. So far as can be determined, this is the chief deterrent. Over and over again it has been argued by parents applying for relief of fees that the son's attendance involves his absence from the farm and the engagement of an extra hand. It is difficult to convey to anyone unfamiliar with the life of a family farm the immense value of a son's or a daughter's labour. To argue that, at most, the child's education will not involve the cost of a heifer or a couple of sows, is futile. As an effort in mathematics the proposition may be true; but it does not really touch the point. A son's labour cannot be expressed entirely—in his parent's eyes, at any rate—in terms of money, and one cannot at present look for advanced views on finance in such matters. Success in family farming is achieved rather by not spending than by big returns on money spent.

With the passage of time, and the gradual growth of the idea of education for farmers' children, no doubt the numbers will grow. Meantime, development of propaganda work is clearly called for.

Curricula and Equipment.—Curricula for the ends in view have had to be evolved. The length and scope of the four courses have varied, but appear now to have settled down to suitable proportions.

Agriculture.—There are, as has been said, two farms. The larger farm is equipped and, in the main, managed as a normal dairy holding, with a herd of 60 commercial shorthorns—recruited in part by rearing and in part by purchase of Irish stock. There are two shippens or cowsheds, one equipped with a Gascoigne milking machine and automatic water-bowls, the other devoted to hand-milked stock. The piggeries provide accommodation for about 20 sows and 150 feeding animals, the equipment including provision for automatic feeding of whey. A good weighbridge forms one of the most useful articles of teaching equipment. Sheep husbandry is limited to early lamb production with flying flocks, and a certain amount of winter feeding of bought-in lambs. The 50 or 60 acres of arable land serve for the growth of forage crops, corn and a small area of potatoes.

The smaller farm, 50 acres in area, is used solely for experi-

ments. Half arable and half grass, it allows of a trial of intensive management of grass land and supports a herd of 25 to 30 cows. The elimination of tuberculosis here constitutes the chief feature of herd management. A tower silo permits of the growth and storage of silage crops, while the remaining area of arable land is devoted to field plots of the usual type.

The agricultural course, to which, naturally, most attention has been given, presents by far the greatest difficulties. The object is to train men as managers of farms. At first glance this seems to call for some sort of practical training. The farming community asks, naturally enough, that the training shall be simple. In reality that demand is asking for the moon. The business of farming hangs in part on economic laws and in part on successful technique, which again hangs largely on appreciation of the principles of natural sciences. The only possible method of attack is to lead up to economic considerations through the principles underlying practice and actual technique.

This cannot be a simple programme. It is, indeed, a stiff programme for 20 weeks, with classes of men unpractised in the arts of the schoolroom, unfamiliar with abstract thought. The problem is simplified, however, by the fact that the staff is a small one. Cyclostyled notes made up in booklets covering each subject form the basis of classroom teaching, and incidentally serve as an exact delimitation of each teacher's province. Practical work on the farm is limited to disciplinary morning and evening duties amongst stock, and a long series of demonstrations on the farm serves the dual purpose of illustrating and relieving classroom work. Naturally, the basis of the teaching in technique and economics is the farm; as experience grows and records accumulate, it becomes possible to hinge teaching on actual practice to an extent which at the outset seemed unattainable.

Science, in the narrow, popular sense, is restricted to principles known to be needed in the teaching of technique. If, on the one hand, lack of academic learning—or, not to put too fine a point on it, lack of general education—in students presenting themselves for training is a severe handicap, it must be admitted that their attainments in other directions simplify the teachers' task. Many a lad, coming at 16 or 17 from a family farm, has a knowledge of stock farming processes and of trading principles which would put to shame some graduates. In general, men of 20 to 24 seem to make the fullest use of instruction provided—in part, no doubt, owing to a

greater stability and seriousness of purpose, but largely owing to their greater experience. Some of the holders of Ministry of Agriculture scholarships have illustrated this particularly.

As a result, the task of turning out a man equipped with the technical knowledge and outlook required by an up-to-date manager in the area, in the space of six months, falls within the bounds of possibility. Mr. Bond, reporting on the final examination last year, wrote :—

“The standard of attainment set by the best students was very praiseworthy. In the subject of practical agriculture, more than half of the candidates gained first-class marks, and they would be capable of making a creditable attempt at degree or diploma papers.”

Poultry Keeping.—The poultry course provides a relatively simple problem. A small holding with two crofts, in the village of Reaseheath, formed the nucleus of the department, now extended by the inclusion of adjoining farm land to 10 acres or thereabouts. This has been equipped with modern plant, the outbuildings converted to form incubator rooms, plucking houses, and so forth, and the farm stocked with utility breeds of fowls and ducks. A single-bird laying trial open to the county is also conducted. In 1923 Reaseheath was selected as the centre of the Northern Breeding Committee's experimental work on breeding for egg production, a site of 10 acres adjacent to the poultry farm being placed at their disposal, and the County Poultry Instructor being appointed honorary superintendent. Though not incorporated either in theory or practice in this department, it constitutes a valuable asset as a demonstration ground for students.

Students are, on the average, possessed of fair general education and, by a queer anomaly, are prepared to devote a longer period to learning the relatively narrow round of poultry husbandry than the agriculture students can devote to the vastly greater round of the farm. They differ from them also in the fact that few have any initial knowledge of practical work, and a mixed course of theory and practice, extending over a full academic year, has, therefore, been designed. This course qualifies for admission to the N.D.P. examination, and is, indeed, modelled largely on the published syllabus for that examination.

Poultry keeping is from a teacher's standpoint “a good subject.” The varied nature of the work, the manifest value of detail, the relatively large volume of established facts, the

ease with which accurate information can be collected, and, finally, the enthusiasm which it appears to develop in every person who studies it—all these features help to make it an admirable subject wherewith to illustrate the application of science to practice.

Dairying.—The nature of the dairying course is determined mainly by the peculiar needs of the area. There is a great demand for skilled workers throughout south Cheshire and northern Shropshire, and ability to convert large volumes of milk into first-class Cheshire cheese is the chief requisite in a dairy hand, although, in recent years, developments in the technique of milk production have led to a demand for other qualifications also.

The dairy is a commodious building, equipped for handling a considerable quantity of milk, particularly for cheesemaking; and in every section sufficient machinery has been introduced to teach students present-day possibilities of labour saving. Most of the equipment, however, is of the hand type, and for the most part conditions of training are similar to those which obtain on the better cheesemaking farms of the area.

The cheesemaking process occupies so large a slice out of a working day, and the craft is withal so largely an art, that it is not possible to introduce much scientific training. Nevertheless, something can be done in the direction of critical examination of processes, in exact measurement of results where means exist, and in the experimental study of methods of measurement where at present sensory standards only are known. The purely artificial nature of the end-product, and the meaningless jargon of trade terms which has grown up around it, as well as the complexity of the material handled, make this, however, a baffling problem.

Practical work is illustrated by short series of lectures on dairy chemistry and bacteriology, and a class in book-keeping is introduced. There are two courses in a year, each course covering 22 weeks.

Horticulture.—Horticulture offers a problem similar in many respects to agriculture. As a distinct industry, it does not figure very largely in local life, though there is a considerable area of market gardening near Manchester and again in Wirral, while fruit-growing flourishes in isolated spots. It was, however, clear from the outset that a demand existed for systematic training in this subject; moreover, the possibilities of development of fruit growing in the area are considerable.

As the gardens offered distinct possibilities, steps were taken to enlarge and stock them as soon as the property was acquired. They now extend to over 10 acres, with separate sections devoted to fruit, market garden crops, flowers and eight glasshouses.

Many of the students who present themselves are unfamiliar with commercial gardening and are, accordingly, required to spend a preliminary period of twelve months at practical work alone before proceeding to the organized course, which extends over a full academic year. The profession calls for a very wide knowledge of technical facts—even wider perhaps than farming. On the scale in which horticulture is locally conducted, technique outweighs organization in importance. Fortunately, most of the technical facts can be acquired equally well in the garden and the classroom. There is, therefore, more continuity of training in the purely practical and organized courses than could be achieved in agriculture. The subject lends itself well, too, to training in the application of natural sciences, and it is possible, therefore, to design a logically connected curriculum in which due weight is given to the natural sciences and to technique.

General Agriculture.—It is not possible to separate the cultural aspects of a course of training from the instructional aspects, since the object in the design of all courses is to make them as cultural as possible. It is, however, pertinent to inquire, before leaving this branch of the subject, what influences of a refining and broadening nature, other than teaching, can be brought to bear. To anyone familiar with the influence of a good school, it will be obvious that mere residence in a disciplined institution, in an atmosphere predominantly intellectual, must exercise a considerable influence, especially on youngsters who have been reared in the more remote backwaters of life. Mere contact with other people of varied type begets a broader outlook and generates a sense of fellowship. These tendencies can be stimulated. At Reascheath there is a Students' Union for the furtherance of social and athletic activities, a dancing class is held every winter, while concerts and social gatherings, occasional lectures on subjects of general interest, debates and so forth, relieve the tedium of study.

It is necessary to write here with caution. Six months of communal life cannot undo the effects of generations of isolation. Individualism is deeply ingrained in the British countryman. None the less, it is possible, even in six months, to develop in

some measure that cultural and corporate spirit which inspires and glorifies our schools.

Extra-Mural Work.—Every member of the school staff is available for county work ; but as the forms which this has taken—lectures, demonstrations and personal visits—are identical with those which have been so extensively studied all over England, attention may be confined to the general aspect of linkage with internal work.

No single feature of our experience has been more striking than the contribution which the central institution has made to the scheme for extra-mural work. Experimental and other studies have come to form the basis of all external teaching ; the fact that most of the advisers or lecturers are personally concerned with trading departments gives to their teaching a colour and tone scarcely attainable by other means, and the centralization of staff allows of free consultation and co-operation. It is remarkable how many of the varied problems of farming are common to all the farms in a district ; comparatively rarely at Reaseheath are we presented with a problem on which no evidence is obtainable from our own departments. One exception should be made, however—noteworthy in itself and as an example of the public benefits which accrue from co-operation between an individual and an educational authority. The north-eastern corner of Cheshire is so different agriculturally from the rest of the county that an adviser with experience only of normal conditions would be ill placed to deal with the special problems of that area. In 1921, however, Mr. W. R. Reeves, farming a 70-acre holding near Stockport, obligingly placed his entire farm at our disposal for experimental purposes, and a long series of studies, by experiment and trial and error methods, has been conducted thereon. This farm has proved a mine of information and incidentally has demonstrated the use which some people can make of scientific advice and guidance.

The method of presentation of experimental results constituted for some years a difficult problem ; bulletins, and leaflets in their baldness and limited range, did not make, even in the eyes of their authors, very attractive literature. They were not, moreover, suited to studies of the trial and error type. Three years ago, therefore, the idea was conceived of publishing a journal consisting of articles by various members of the staff, discussing general topics, in a comprehensive and readable manner, in the light of such experimental and other evidence as we had. Three volumes have now been published

under the title *The Reaseheath Review*. They have met with an excellent reception, and it is intended to continue publication annually. Receipts from advertisements—a regrettable necessity—permit of sufficient copies being issued to supply every farmer in the county.

In the various educational developments sketched, we have been fortunate in the active co-operation of the chief farmers' organizations in the area, particularly the county branch of the N.F.U. Most of the senior officers of the staff are members of one or other committee of the branch. Recently the chief dairy instructress has, by acting as their first "grader," rendered material assistance to the Cheshire Cheese Federation in its infancy. This arrangement is noteworthy as an example of a direction in which educationists can assist in a purely business matter, but still more noteworthy as an index of the confidence reposed in an educationist by informed farming opinion.

Women's Institutes have come to form a valuable connecting link between the education authority and the fairer portion of the rural community. A large number of lectures are given annually to these bodies, and in a number of instances special courses of instruction have been designed to meet their needs. From the standpoint of propaganda they are valuable organizations.

Another type of organization which has been fostered in co-operation with the N.F.U. is Young Farmers' Clubs. These are educational and social clubs, membership of which is open to farmers' sons and young farmers. As a rule they meet fortnightly in market towns for educational purposes during the winter months; and during the summer a number of excursions, judging competitions, and so forth are held. Eleven such clubs have been formed in the county in the course of the last five years. They undoubtedly present immense possibilities in the development of progressive ideas, whether of production, marketing or social life. Nearly every member is in a position to undertake book-keeping, recording, experimental work, or at the least to apply directly and immediately the results of scientific teaching. Candour compels one to admit, however, that they do not always fulfil the prospects which their foundation promises. One or two clubs after a promising start have "fizzled out"; enthusiasm nearly always wanes after the first two years, and constant stimulation is necessary. It is greatly to be regretted that limitations of staff prohibit much time being devoted to them.

There are, however, limits to the work which a handful of people can do. Advisory work by means of personal visits has grown in the space of ten years to such proportions that fulfilment of all demands is out of the question. Competitions, shows, evening lectures, meetings, public demonstrations, experiments, succeed one another with bewildering rapidity. In season and out of season there are the demands of the central institution with its student roll of 70, its trading departments, its experiments and studies. Well may we say with Mr. Fips, "Plenty to do, plenty to do!"

PRECAUTIONS TO BE TAKEN WHEN FILLING SILOS

THE accident at Manor House Farm, Stretton-under-Fosse, near Rugby, in June, in which Mr. W. T. Crofts, a prominent local farmer, and two farm workers lost their lives on entering a silo which had been partially filled, has doubtless given rise to apprehension in the minds of many who may be similarly engaged. The fatality, however, appears undoubtedly to have been the result of a combination of unusual circumstances, and if the precautions recommended below are taken no danger need arise from the use of silos.

Immediately after the coroner's inquest an inquiry was commenced into the circumstances of the fatality. The services of a representative of the School of Agriculture, Cambridge, and one of H.M. Engineering Inspectors of Factories were placed at the Ministry's disposal, and the substance of their reports is given below.

The silo in which the accident occurred was a cylindrical iron tower about 30 feet high and 12 feet in diameter. It was roofed at the top with an opening for ventilation and had two holes in the sloping sides of the roof, through one of which the blower tube entered during the process of filling. The other hole was left open during the operation. As is usual, there were doors up the side of the silo. The distance from the bottom of one door to the bottom of that immediately below it was 4 ft. 6 in. The only means of entrance was through the doors by means of a fixed iron ladder. The silo had been in use for four years and, so far as could be ascertained, no noxious gases had been noticed during that period. Before being used this year it had been cleaned and had received the customary coat of paint inside.

The forage which was being fed into the silo consisted of oats, vetches and a small quantity of beans. The crop had been grown on heavy land and was yielding a large quantity of fodder. Examination of the growing crop on June 20, seven days after the accident, did not reveal the presence of weeds or abnormal constituents, but the vetches were not quite in full flower, the beans were just beginning to blossom and the oats had not quite reached the flowering stage. Now the earliest stage of maturity at which such a crop should be cut for silage is when the oats are in full milk and the vetch pods are full grown in length, with seeds about half-formed. At this medium stage of maturity, the type of silage known as "green fruity" silage is obtained. The crop may be cut at a later stage, but not earlier. For example, the common "acid brown" silage is produced by cutting when the vetches are well seeded and the oats have passed the milky stage. It is important to note that the crop as cut in the present instance was very immature. On the other hand, the Ministry has learned that owing to the heavy crop this year other farmers have cut their tares for silage much earlier than usual and in a very green state.

The loading of the silo had been commenced on Tuesday, June 10, and had proceeded normally on the following day. On the Thursday, however, only four cartloads were fed to the silo, the last being at 3.30 p.m. There were then three doors of the silo closed and sealed, and the level of the crop was about one foot below the lowest open door. For the guidance of those with little practical acquaintance with silos, it should be explained that the doors open inwards and, as the crop reaches the top of a door, the door is sealed on the outside. This is an important point in connexion with precautions to be taken. During the Thursday night the level in the silo sank about 4 ft. 6 in., while the normal fall was stated to be 3 ft. Only four loads had been fed to the silo during the day, and if the treading had been less than usual the exceptional fall in the level would be explained.

The position on the morning of the tragedy, June 13, was that the level of the silo was about 5 ft. 6 in. below the bottom of the lowest open door, forming a well 5 ft. 6 in. deep, with no ventilation, in which the gaseous products of fermentation had collected.

With regard to the accident itself, it will be sufficient to say here that it would appear that the two farm workers entered the silo, as was their custom in the morning, to continue

treading the contents prior to commencing to fill the silo during the day. Mr. Crofts lost his life in an attempt to save them when their condition was brought to his notice.

The evidence given at the inquest and general considerations point to asphyxiation from carbonic acid poisoning as the cause of death. It is possible that other toxic gases besides carbon dioxide may have been evolved, but the symptoms described by witnesses are consistent with carbonic acid poisoning, and the presence of other gases cannot be assumed.

The main changes that take place during ensilage can be grouped under three headings:—

(a) **Respiration of Plant Tissues.**—This results in the breakdown of carbohydrate material into carbon dioxide and water (plus heat) when plenty of air is available. If, however, only a limited supply of air is present, oxidation is incomplete and a much smaller quantity of carbon dioxide is formed.

(b) **Enzyme Activity.**—This results in the splitting up of proteins into much simpler products.

(c) **Bacterial and Fungal Activity.**—These yield many products, but the chief changes are the production of organic acids, the partial breakdown of cellulose and, under certain circumstances, the putrefactive decomposition of nitrogenous material.

Any immaturity in the crop being fed to the silo on this occasion would favour the splitting up of carbohydrate and protein material. Further, the crop had been cut and had been allowed to wilt in the field for two days before it was fed into the silo. The weather conditions were hot and dry during the period, so that the material was very dry and would not have settled so compactly as unwilted material, and more air would be retained in the material as fed to the silo. A greater opportunity was thus afforded for a more complete oxidation of the carbohydrate material with the evolution of a larger volume of carbon dioxide. This process would be assisted if the material had not been well trodden over night. Moreover, the thundery conditions which prevailed during the night may have accelerated fermentative changes with an increased destruction of carbohydrate and nitrogenous material and an abnormal generation of carbon dioxide.

Whilst one or two of the factors enumerated above might be expected to be in operation in any given case, a combination of all these factors would be a very rare occurrence and would be sufficient to cause an abnormally high evolution of carbon dioxide. In addition the air was very still on Thursday night,

with the result that there was very little movement of air in the upper part of the silo, and no air currents to disturb the air in the well formed by the shrinkage of the material.

Precautions.—If farmers, when filling a silo, would take the following simple precautions, the use of silos should not be attended by danger to human life. The observance of points (3), (4) and (5) would obviate any danger even under such a combination of circumstances as occurred in this case.

(1) The crop should have reached the proper stage of maturity and should not be too dry. With an immature crop the extent and nature of the fermentation that will take place is uncertain; an abnormal volume of carbon dioxide or possibly other dangerous gases may be generated. If the material is very dry it will not tread down closely; the additional air so retained would cause the evolution of a larger volume of carbon dioxide than usual.

(2) The material which has been fed into the silo should be well trodden before work is closed down for the night or for any considerable period during the day. The reason for this is that loosely-packed material will retain more air and, therefore, give off a larger volume of carbon dioxide than material which has been well trodden.

(3) No door should be sealed up unless it is absolutely certain that the material will not sink below the level of the bottom of that door.

(4) Before work is resumed, whether in the early morning or at any time during the day when work has been suspended for any length of time, the lowest door possible should be opened. No one should be allowed to enter the silo until a reasonable time has elapsed after this has been done.

(5) Where the silo is being filled by an elevator, as long an interval as possible should be allowed after the lowest door has been opened to allow any harmful gases to escape. Where a blower is being used to fill the silo, this should be put on for a few minutes before anyone enters the silo, with the object of removing all the stagnant gases. It has been suggested that it would be of assistance in this connexion if the trunk from the blower to the silo were extended downwards inside the silo by removable sections to as near the level of the silage as possible.

The composition of the gases resulting from the fermentation of the silage varies according to the material used. In exceptional circumstances some of these gases might be of an inflammable character. It is, therefore, necessary to add

a warning to farmers not to adopt the common method of ascertaining whether air is foul, namely, that of lowering a lighted candle. Should any inflammable gases be present, an explosion might follow.

A full account of the standard methods practised in this country when making silage is to be found in Miscellaneous Publication No. 53, issued by the Ministry, price, quarter bound, 1s. net, post free.

CUTHBERT CLARKE AN 18th CENTURY BOOK-FARMER

G. E. FUSSELL,

Ministry of Agriculture and Fisheries.

LIKE many others of the innumerable writers on agricultural subjects, who may or may not have flourished in the eighteenth century, Cuthbert Clarke remains to us only in his printed word, and in the records of the Royal Society of Arts. From that Society he obtained two awards, one of money and the other a medal, but his book, which was issued in 1777, is perhaps his most important claim to attention. Its full title is :—*The True Theory and Practice of Husbandry deduced from Philosophical Researches and Experience : To which is added, A Compendium of Mechanics.*

Donaldson* gives a very just and concise account of the work. "The dedication of the book on husbandry," he says, "is dated from Durham and addressed to the proprietors and occupiers of land. The intention is avowed to resolve the hitherto varied art of husbandry into a science, and to do so with propriety and clearness. The first section of the theory of agriculture very curiously introduces into it the form of cash accounts in ledger and general receipt books. Then follow the form of receipts, bills and promissory notes and common bills of parcel. The curvilinear shape of ploughed ridges of land are very correctly delineated and the position of the furrow slice is very exact. A general conversation is managed between two speakers, 'Philosophus and Agricola,' who discuss the common topics of farming in an enlightened manner. A form of a lease is given, along with the expenditure and receipts on an arable farm of 300 acres. The second part of the book on mechanics delineates some forms of ploughs ; but nothing new, or very worthy of notice. The Rotherham plough is shown with straight handles."

* *Agricultural Biography*, 1854.

Donaldson also states that Clarke was a lecturer in experimental philosophy, and that he published a book on weights and measures, which was of some repute at the time. The title of this book was *A New Complete System of Weights and Measures deduced from an unerring universal unit*, and it was issued at Edinburgh in 1789. Other works of his were *Remarks on the Observations of R. Whitworth upon the plans delivered to . . . the Lord Provost and Council of Edinburgh, for enlarging and improving Leith Harbour* (Edinburgh, 1787); and *A Philosophicall Investigation into the Origin, Vicissitudes and Power of Steam employed in a Fire Engine; with an explanation of that machine* (Newcastle, 1773).

Clarke's claim to attention, however, rests upon his farming production, and upon the inventions he placed before the Royal Society of Arts. The former he declares to contain his best endeavours to be useful to mankind, and he adds that a competent knowledge of both theory and practice are requisite to enable the harassed farmer (there never has been a time when the adjective was not applicable) to cope with the emergencies he was bound to meet with in the course of his career.

The form of accounts, at which Donaldson has a small gibe, is an intelligent anticipation of a requirement which is steadily becoming more and more emphasized. No one would suggest that it fulfils the demands of modern cost accounting, about which so much has been written for farmers of late, but it is a step in the right direction. Clarke wanted the farmers of his day to keep accounts in order that they might take a more than intuitive view of the success or failure of their various crops. The most emphatic of our agricultural advisory economists demands little more.

Whether he was ever an actual farmer or not, Clarke has a keen perception of the possibility of increasing rent and the margin of yield which would allow the tenant to pay it. He advises care that "the land is not unfairly stripped of its treasure: For if land is reduced to so low an ebb, that the occupiers cannot reap more than fifteen (Winchester) bushels of wheat, and twenty of peas; or fifteen of wheat and twenty-five of oats per acre from a two crop fallow; it is impossible at the present prices of grain (and they are not bad ones) that he can pay either tithe or rent for such land."

As Donaldson says, the book deals with the common matters of every-day farming, so that we find a discussion of the correct size of the furrow slice, the best depth of ploughing, and—what is even more important for the modern reader,

who is unlikely to be anyone not interested in the history of agriculture—occasional remarks upon the common practice of some localities.

Again it is only natural that in discussing the breeds of cattle, sheep and swine Clarke should state where those he specifies were to be found, and, although information of this sort is not explicit, and does not give any idea of the proportion in number of the different types (they were often hardly distinguishable in spite of their varying names), it is on such slender evidence that the historian is forced to rely. The lack of more definite information does prevent us from estimating with an accuracy that cannot be impugned the development of the production and supply of foodstuffs in the eighteenth century: at the same time some quantitative estimate of some of the main items of the common menu may possibly be formulated.

As an experimental philosopher, Clarke had ideas that were not the common possession of his time. He says that he had found that electricity assisted digestion in the animal stomach and the growth of plants in the soil, and he adds in a footnote that experiments carried out by the Abbé Nollet and M. Jallabert confirm his view. I am not equipped to criticise him or to compare what he says with the results of modern scientific experiment, which are, I believe, still indeterminate, although widely discussed. It is significant that "*Agricola*" admits all "*Philosophus*" has to say on the subject, but asks "whether that operation . . . may not yet be compared to placing a pump by the side of a spring of water, in order to fill a reservoir in a less space of time," which it will undoubtedly do. Clarke goes on to say that he has made experiments to test the effect of "electrics" on capillary action in the soil. He used tubes of a very varied selection of materials for this purpose and claims that the "natural electrics," i.e., glass, sealing wax, etc., by simple immersion raise water higher than the non-electrics such as tin, lead, etc. The latter, he implies, when electrified by a machine, do as well as the former.

In the realm of experiment his achievement was his draining plough. For this plough "he had a premium of fifty pounds, October 8, 1766,"* and an improved version was purchased by the Society of Arts on June 1, 1767.†

* Robert Dossie, *Memoirs of Agriculture*, Vol. II, 1771. In Vol. I, 1768, p. 79, the dates are given differently.

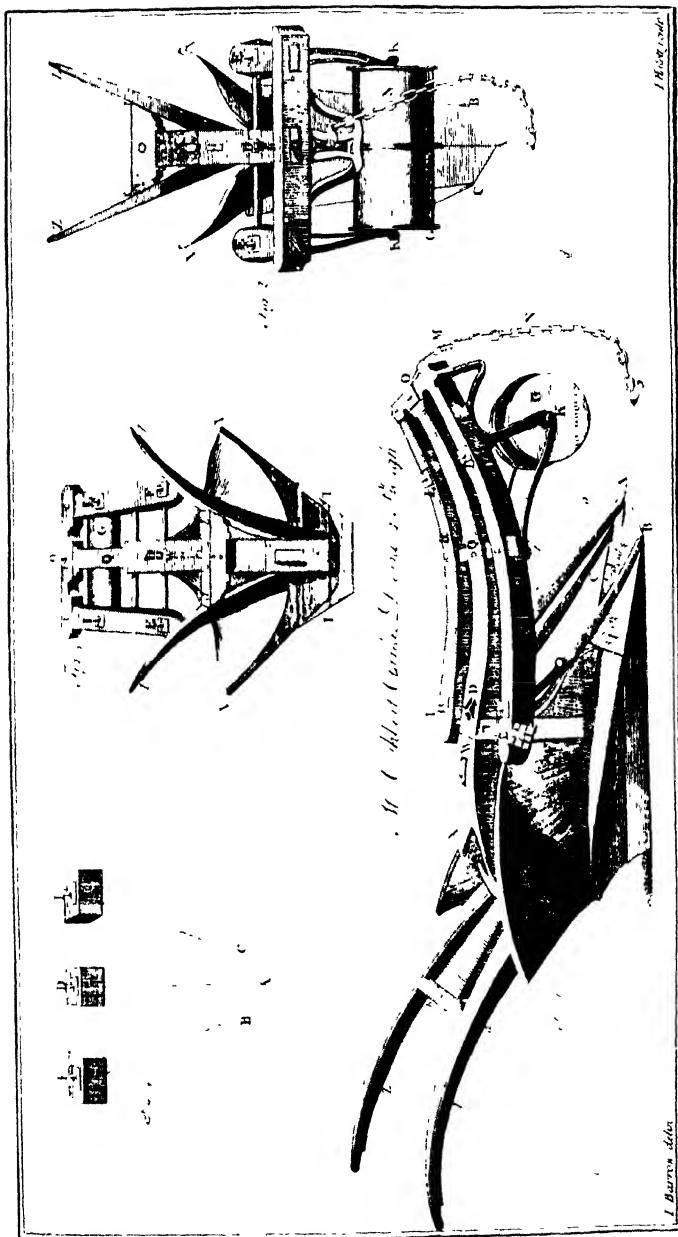
† *Op. cit.*, Vol. II.

At this time various draining ploughs were put forward, and the Society also awarded a premium of fifty pounds for one by Mr. William Knowles in 1767, while a Mr. William Makings not only had a bounty of fifty guineas for a plough for making trenches for closed drains, but ten guineas for making a complete plough and carriage. A footnote adds that the last machine would work with four horses, and had earned the "golden" opinion of the Society.

Clarke was a little impatient of his competitors in this field. He gives a plate illustrating the implement amongst others, but the draining plough naturally takes precedence of the more ordinary implements. Of the Society, he says they "were so exceeding cautious in deciding the claim that they appointed a time for the trial of each candidate's machine, made in full size : " six or seven were tried and he got the premium, although he adds in what is no doubt intended to be a completely significant manner " a stranger to all present." As we have seen, however, he was not the only inventor (designer is probably a better word) of a drain plough who was awarded a premium. One of his other plates shows a one-wheel plough of his design for which the Society awarded him a gold medal.

Some fifty years later, Clarke's draining plough is mentioned in terms of no high praise, so perhaps it was not quite so efficient as its inventor believed. Lawson, writing in 1826,* says : " Without noticing all the varieties of ploughs, which have been invented, but not found generally useful, there is one called Clarke's draining plough, which deserves to be mentioned. It is used in Meadow ground, near Belford, in Northumberland " (Clarke lived here at one time), " but cannot be used in stiff clay. Grays' draining plough seems one of the best . . . " We therefore see that Clarke's plough was used long after his book was read ; the plough could only be used with advantage in a particular soil, and the book has sunk into oblivion. Such publications have an ephemeral practical use and are afterwards read, not only for the extraordinary mixture of practical advice and grotesque theory they contain, but because they inform us what was thought and done in an earlier day.

* A. Lawson, *Farmers' Practical Instructor*, 1826, p. 97.



4th edition, 1793

Reproduced from the engraving in "The C couple" (Lamont) by a Society of C. in London
 The same engraving, however, appears in the 1st edition, 1756

NEW FOREST GRASSLAND COMPETITION, 1929

L. G. TROUP, B.Sc.,

Agricultural Organizer, Hampshire,

and

T. W. WILLIAMSON, B.Sc., N.D.D.,

Assistant Agricultural Organizer, Hampshire.

IN the spring of 1929, the New Forest Agricultural Competitive Association sought the advice of the writers on the organization of a grassland competition, which it was proposed should be carried out during that year, and invited assistance in framing the rules and carrying out the competition. In the opinion of the writers, grassland competitions are a most valuable form of agricultural education work. A competition was, therefore, arranged; and it was felt that, considering the short time available, and the experimental nature of the system adopted, the entry of 22 competitors was sufficient and satisfactory.

As a preliminary, it seemed desirable to consider the scope of the competition very carefully in the light of the experience gained from similar tests in the past.

Previous Competitions.—Earlier competitions, notably those undertaken in Cumberland and Wales, resulted from an increased demand by farmers for advice on the best method of seeding down land to permanent grass, and of treating such pastures in their early life. The competition was directed first to this end, but a second, and more important, object was the efficient dissemination of the lessons learned in the districts concerned.

In these competitions, the judges visited each competitor, and obtained from him information on the history of the field, seeds mixture used, manuring and treatment; they then viewed the field and allocated marks on the botanical composition of the sward, evenness of grazing, freedom from weeds and general condition of the pasture.

This pioneer work undoubtedly separated good practice from bad in each district, and the final report of the judges, in which individual competitors were identified only by code numbers, criticized each of the fields entered, and ensured that the experience gained was placed at the disposal of all farmers in the neighbourhood.

The New Forest Area.—The New Forest has long been predominantly a grass area, and contains only a small acreage

of pastures laid down in recent years. Established pastures had, therefore, to be included, and the competition resolved itself into a test of skill in grassland management and not a test of methods of pasture formation.

In judging the efficiency of management, it was obviously necessary not only to have some measure of the production but also of its cost; and, in addition, it was regarded as essential that all competitors should start with an equal chance, irrespective of the fertility of the land. An attempt was also made to ascertain how far each of the factors affecting the maintenance of good grass land was responsible for the result, and what attention was given to each of them when successful management produced a satisfactory financial return.

The objects of previous competitions had not been so comprehensive in their scope, and a question arose whether the methods adopted for them would be suitable for the wider range of the test under consideration. It was finally decided that the adoption of the earlier methods would entail so many drawbacks that it would be preferable to evolve a new technique.

It was thought desirable, in the first place, to keep an open mind on the subject of an ideal turf, and attempt to determine, on a large scale, the type of sward which gives the best result. A second consideration to be kept in mind was the comparative ease with which a competitor could adopt "window dressing" tactics with a single field—possibly a naturally more fertile field than the remainder of the farm—even perhaps to show that special attention and liberal treatment on a limited area pays very well; but results secured in this way may be negatived when applied to a farm as a whole.

Obviously, also, the productivity of grass land, which, when balanced against the cost of production, is the criterion of grassland management, can only with difficulty be measured on a limited area of grazing land by keeping accurate stocking records; whereas the productivity of the grass land on the farm, considered as one unit, can be much more easily estimated.

Chiefly on these grounds it was finally decided that all the permanent grass land on the farm (exclusive of rough grazing) must be examined before any real estimate of the skill of each competitor could be obtained. It follows naturally that, in a competition of skill, as compared with productivity, it

would be necessary to estimate fairly accurately the economic possibilities of each farm under ideal management, adopt this as the standard, and mark competitors on their approach to this standard. Otherwise competitors with naturally poor land would be handicapped from the outset.

In practice few men have the special knowledge requisite in assessing the possibilities of each farm and in analyzing and suggesting remedies for errors in management, and for this reason a trained agriculturist should act as one of the judges in all grassland competitions. Two judges would appear to be desirable, though no hard and fast rule can be made.

It follows, too, that more than one visit to each competitor is required in order to determine that the best use is made of the grass land throughout the grazing season.

The New Forest Competition was undertaken rather late in the year, for under normal conditions a first visit ought to be paid about mid-April, to ascertain if nitrogenous dressings were used for early grass and their effect; a second visit should be made at the flush period about the end of May, and a third in September when the hay in rick should be examined for quality, and if necessary the quantity estimated. In the 1929 competition, however, only the two later visits were possible.

The question of allocating the competitors into several classes received careful consideration. It would appear that an owner-occupier, with greater security of tenure, has more incentive to keep his land in a high state of fertility than a tenant farmer. Further, an owner-occupier may reasonably be penalized for not draining a wet field, for failure to sub-divide areas of grass land which are too large, for neglecting to instal a water-trough in an unwatered grazing field, or for other things involving capital expenditure for which it would be unfair to penalize a tenant farmer. Classes in the competition were therefore provided for owner-occupiers and tenant farmers.

Each class was again sub-divided on a basis of acreage, *i.e.*, above 50 and under 50 acres of permanent grass on the farm. Usually management is simplified on the smaller farm, and a higher level of fertility is more easily reached. This sub-division was also adopted in order to simplify the task of the judges.

The Basis of Judging.—The basis for the award of prizes and

the allocation of points was left to the discretion of the judges, and the following provisional score card was adopted :—

	<i>Marks</i>
Performance (including stocking, length of grazing period, and hay crop)	50
Quality of herbage	20
Freedom from mat	10
Even grazing	10
Drainage and condition of fences	10
	<hr/> 100 <hr/>

The score card was purposely framed with some latitude and in practice it was used only as a guide.

On the first visit, the total acreage of the farm, and the respective acreages of arable, temporary and permanent grass, together with the number of grazing stock carried were noted. It was fortunate that, in the district concerned, stock was practically limited to horses and cattle, so that few calculations involving estimates of the grazing capacity of different classes of stock were necessary. Further, green arable crops were utilized on very few of the farms before the early autumn to supplement the grass—again simplifying calculations of stock-carrying capacity.

The estimated number of stock carried by the permanent grass obtained from these figures was later checked by observing the amount of grass and the condition of the grazing stock, and by reference to the quantity of purchased feeding stuffs fed on the grass.

Each judge had a notebook and made separate observations on each of the fields (which were numbered), including the following items: Acreage; whether grazed or reserved for hay; past history including manuring, cropping and cultivations, and, if a new pasture, details of seeds mixtures used; type of soil (usually a turf was lifted); botanical composition of the herbage; absence of tufts (where grazed) or productivity where mown; absence of mat and weeds; condition of fences, ditches and drains; and particulars of any unusual features. Where two or more fields were grazed together the reason was ascertained.

In addition to the notes made on each field, the judges during their round of inspection with the farmer kept before them the conception of all the grass land on the holding as a unit, considered the size of each field in relation to the farm as a whole, noted the system of manuring and the proportion of grass laid up for hay, and questioned the farmer

on his difficulties and experiences, and on any and every point which appeared to influence his methods of management.

The tour of the farm completed, each judge decided upon the standard which he could reasonably expect the competitor to reach in productivity and quality of pasture, commensurate with satisfactory financial returns if the farm were ideally managed, noted how far he fell below this standard, and allotted him marks out of a possible 100. The judges then compared results, and in only one case, before consultation, did their figures vary by as much as 5 per cent.

On the occasion of the second visit, further general information was obtained regarding each farm, the hay was inspected and the fields visited in the same order as before, and these further observations added to the previous record.

The Final Reports.—The final report of the judges was presented in two portions. The first contained their general observations on the chief features of all the grass land examined, and received adequate publicity through the Society, who also secured its publication in a prominent local newspaper. The second portion consisted of a series of detailed reports on each farm (under a Code letter and a number) including the notes made by the judges on each field and on the farm as a whole, on each visit, with their criticisms and suggestions for improvement. In our estimation, this detailed report is supremely important, and very considerable time and thought was devoted to it.

A few notes of the judges' experiences will perhaps be of interest :—

In the first instance, they attempted to rid their minds of two preconceived ideas, namely :—

- (1) That skill in management necessarily entails high output.
- (2) That a sward consisting of a well-balanced mixture of " good " grasses and clovers is a *sine qua non* of good management, and is normally essential for high output.

Consequently their allocation of marks to competitors in the first round was provisional only until they had sufficient evidence to justify a decision. They were eventually satisfied (though they necessarily arrived at this conclusion by empirical methods) that skill in management, which involves reasonable hope of a satisfactory financial return, does entail maintenance of output at a high level.

Second, by comparing the type of herbage in the pastures with stock-carrying capacity, they were finally satisfied that in

the particular district concerned, a balanced grass and clover herbage is the basis of high output with moderate costs, since, not only is the stock-carrying capacity high, but maintenance is easier because of the more even grazing, less expensive cultivations required, and greater water retention in drought. A certain latitude, however, is permissible in the case of fields regularly mown for hay.

They were surprised that the average difference between competitors in the owner-occupier and tenant farmer classes was so small as to be negligible. Broadly, they noted that the owner-occupiers spent more on fertilizers, but devoted less time to cultivations than the tenant farmers, who, with more modest fertilizer bills, secured comparable and perhaps even better results by paying considerable attention to regular harrowing, rolling and close rotational grazing. An excellent example of this peculiar feature was provided by the champion prize winner, a tenant farmer, whose pastures, on naturally poor soil, stood out in marked contrast to the surrounding land, and whose methods of management were extremely sound, yet very economical both in cash outlay and in total cost.

One drawback became apparent in the cases of two competitors who had recently entered their holdings. By the method adopted, farms were judged as they were found, as compared with their estimated condition under ideal management, and consequently the present occupiers received the benefits or disadvantages of the legacies handed down by previous tenants. To attempt to make allowances for these legacies would, in the writers' opinion, render the task of judges who know nothing of the previous condition of the farms much more difficult, and admit a more serious risk of error.

The notes on the practical details of grassland management in the district show that from the first the judges were struck by the outstanding uniform success of the Cockle Park type of seeds mixture in pastures laid down during recent years. Rotational grazing certainly resulted in better pastures, and a higher stock-carrying capacity.

Hay crops on the whole were heavy in spite of the drought, and they were satisfied that mowing the same fields each year, when combined with adequate manuring and heavy grazing of the aftermath, resulted in heavier crops, and the increase in crop usually followed on what, at first sight, might be regarded as deterioration in the botanical composition of the herbage.

The advantages of using artificial fertilizers were well understood by all the competitors, but the advantages of adopting some system in their application were less generally grasped. Odd cases of injudicious and extravagant dressings came to our notice. On the other hand, the necessity for cultural treatment and control of grazing was not appreciated as it ought to be.

The acreage dressed with nitrogenous fertilizers surprised the judges, and though the first visit was paid too late to gauge results in early grazing, applications on the hay crop were yielding very satisfactory results.

Lime gave excellent results on young pastures, but the returns on established turf were not nearly so certain.

It was also frequently brought to notice that the first stage in the improvement of a poor pasture, namely, securing an increase in the clover population, is a fairly easy and speedy process, but that the second stage of improvement, replacement of the useless by the better species of grasses, requires a much longer time and is less certain.

It is pleasing to record the educational success of the competition, as evidenced by the keenness of the competitors, their appreciation of the constructive criticism contained in the detailed reports on their farms, and their enthusiasm for a similar competition in the current season.

It may be mentioned also that a large number of inquiries regarding the competition have since been received from other districts in this country, both by the writers and by the Secretary of the Society, and although a great deal of time must be devoted to organization and judging, the results are worth the time and trouble expended.

Only a limited number of competitors can be dealt with each year (though the actual number will depend on the average size of the farms in the district concerned), and it would appear to be necessary, in framing the conditions of such competitions, that a farm entered in one competition shall not again be eligible for entry except after some interval of time, thus allowing the competitor time to act upon the advice given.

Further, though three visits may be considered the ideal, two visits should be sufficient to arrange the competitors in order of merit, and a third visit may only be really necessary in a limited number of cases where few marks separate competitors who have a chance of winning a prize.

The writers are agreed that they have not yet sufficient reason for suggesting any radical alterations in the methods or technique of adjudication, experimental and empirical though they may be, and they are not at all satisfied that an accurate stocking record, or even the less practical costing of the grass land, would solve the major difficulties.

Conclusion.—In conclusion, the writers have carefully considered also the extension of this work by initiating a Grassland Improvement Competition, and have rejected the idea for the present on two grounds. Firstly, the County Organizer must be available to all the farmers in the county for advice, and naturally many competitors would obtain his assistance in an advisory capacity. The effect of such a competition might be primarily regarded as a test of the skill of the County Organizer in diagnosing the troubles on the various farms, and in selecting the correct treatment—and only to a very small extent a test of the skill of the farmer.

Secondly, not all grass land reacts to efficient treatment at the same rate, and it appears at present impossible to differentiate with any precision between a naturally slow reaction and slow improvement consequent upon inefficient methods.

It has therefore been decided that the 1930 Competitions in this county will follow the lines of that of 1929. A limited area only will be covered in any one competition in order to eliminate, as far as possible, the difficulties which might arise through securing entries of widely different types of farms.

Grassland competitions appear to offer an excellent opportunity for co-operation with local agricultural societies, and their educational value may be regarded as important as that of the show, or the ploughing or other manual process competition. They offer a far greater opportunity than other types of crop competition as usually carried out, if only because of the large acreage of grass and the need for general improvement in its management.

EFFECT OF CONSOLIDATION UPON THE BOTANICAL COMPOSITION OF POOR GRASS LAND

G. H. BATES, B.Sc.,

Senior Agricultural Instructor, West Norfolk.

THE term consolidation is here used to denote any mechanical compression or treading of the surface of grass land by animal or human agency. The popular term for this process is "hoof cultivation."

The outstanding contrast between the herbage of the footpath or gateway region and the remainder of a pasture is too well known to need description. It is generally understood that the difference is due to consolidation.

The radical changes induced by consolidation are ascribed to various factors, and the writer has attempted to investigate the exact part played by each factor. The theories arising from the observations have been tested experimentally.

Botanical analyses of the consolidated and of the adjoining unconsolidated portions were made during the winter of 1929-30, and under widely differing conditions. The first three analyses set out below were made in North Lancashire, and the remainder in North-East Derbyshire. A large number of cursory observations in other localities have confirmed the first findings.

In the following examples the percentages express the proportion of ground covered by the different species. In the case of footpaths, areas which were trodden bare were not included, and in each case marginal regions were neglected, but are discussed later. The Broad-leaved Plantain (*Plantago major*) was often present to the extent of 30 per cent. of the ground covered, but, as the plants were dead or dormant in winter, they were neglected.

The areas numbered below are as follows :—

Area	Place	Formation
1. Sheep Walk	.. Tarn Hows	.. Silurian Limestone
2. Larch Wood	.. Gooseyfoot Tarn	.. Silurian Slate
3. Ungrazed Paddock	.. Hawkshead Hill	.. Boulder Clay
4. Pasture	.. Whitwell	.. Magnesian Limestone
5. Pasture	.. Ashgate	.. Coal Measures
6. Ungrazed Paddock	.. Ashgate	.. Coal Measures
7. Pasture	.. Hardwick	.. Magnesian Marl
8. Mixed Wood	.. Walton	.. Coal Measures

The consolidated portions represent footpaths, except in examples 4, 5 and 7, where gateway regions were taken.

[illegible]

It was not considered necessary to carry out the analyses in great detail, as the object was to illustrate a fact which may be confirmed by observation.

The figures, in the case of the consolidated portions, exhibit a remarkable similarity. The following species are dominant or sub-dominant, in every case, and practically exclude all other species: *Poa pratensis*, *Lolium perenne*, *Trifolium repens*, *Dactylis glomerata* and *Cynosurus cristatus*.

An examination of any flagged footpath or sidewalk, where grass grows between the flags and is well trodden, reveals the fact that *Poa pratensis* is not only dominant, but other species are present in such small amount as to be negligible. The runners enable this plant to penetrate the interstices, but other plants possessing runners are killed off.

FLAGGED FOOTPATHS AND SIDEWALKS

(Average of 20 Cases)

Margin of Path	per cent.	Interstices of Flags	per cent.
Bent (<i>Agrostis</i> spp.)	.. 35	Smooth-stalked Meadow-	
Woolly Softgrass (<i>Holcus mollis</i>)	15	grass (<i>Poa pratensis</i>)	.. 95
Sheeps Fescue (<i>Festuca ovina</i>)	25	Miscellaneous	.. .. 5
Couch or Twitch (<i>Agropyrum</i>			
repens)	.. .. 5		
Wild White Clover (<i>Trifolium</i>			
repens)	.. .. 5		
Smooth-stalked Meadow-			
grass (<i>Poa pratensis</i>)	.. 5		
Annual Meadow-grass (<i>Poa</i>			
annua)	.. 5		
Miscellaneous	.. . 5		
	100		100

An experiment, aiming at a close imitation of the action of the hoof during wet weather, was carried out by Capt. J. D. Penrose in Hardwick Park. An analysis of the resulting herbage and a comparison with the untreated portion gave results similar to the above examples.*

Out of 58 footpaths examined, it was found that in two cases the rule did not hold good, the herbage consisting of a mass of fine-leaved fescue, mainly in a dead condition. An investigation into the cause showed that the underlying earth was excessively dry. One path traversed the site of old ironstone workings and the other was on a raised road, built on ashes.

Even on these dry roads, small patches of *Poa pratensis* and *Lolium perenne* were observed, though they were in small hollows where moisture had collected and puddling had taken place.

* This JOURNAL, Vol. xxxvi, No. 4, p. 323.

It appears that treading alone is not responsible for the change, but that soil must be brought to the surface. In this connexion it has been observed that attempts at mechanical improvement of grass land on dry hillsides have been doomed to failure, whereas close treading with sheep in wet weather has effected the desired result.

Discussion of Factors.—The factors responsible for the changes brought about by consolidation may, at first sight, appear complex, but an examination of each one in turn points to one factor as primary and others as secondary. As the importance of mechanical improvement and cultivation of grass land along the lines of "hoof cultivation" is becoming realized, it was thought that an attempt to understand the exact way in which the change is brought about might be of economic as well as scientific value.

The factors are considered in the following order by a process of elimination :—

Plant Food.—The fact that the consolidated parts of a pasture are closely grazed means that they receive an extra supply of droppings and urine and this will, in some degree, show a result. In examples 3, 6 and 8, however, there was no grazing by stock, and in examples 3 and 6 even rabbits were excluded.

The deep green coloration of the consolidated areas may be explained by the deep green colour of the dominant species (with the exception of *Dactylis glomerata*), and to the fact that *Poa pratensis* and *Lolium perenne* are winter-green grasses.

Water Supply.—On a matted pasture, the footpath and gateway region will offer a much readier access to water than on parts where the herbage is matted. The fact that many of the dominant species on the consolidated area are deep rooted augments the water theory, but on the other hand *Poa pratensis* is very shallow rooted. In the case of example 4, the turf was all of a very open nature and covered with worm casts. In the case of flagged footpaths, the soil is always moist beneath the flags.

While there is no doubt that the free passage of water, forming a reserve in the soil, is beneficial to many pasture plants (as evidenced by the practice of turf slitting on matted pastures), it does not appear to be the dominant factor in this case.

Light.—There is no doubt that light is a potent factor in the case of *Trifolium repens*, but both *Dactylis glomerata* and *Lolium perenne* can compete for light. In example 2, where the turf was shadowed by trees, *Trifolium repens* was absent.

Bruising of foliage will allow the access of light, as will the inhibition of the tall habit, but an example of suppression of foliage without consolidation may be seen on lawns or putting greens. The dominant species are those which can escape severe cutting.

The following analysis of a cricket pitch and the surrounding herbage will illustrate this point. The example is typical of most lawns of long standing, whether they have been manured or not:—

CRICKET PITCH AND SURROUNDS: HARDWICK PARK

<i>Unmown portion</i>		<i>Mown portion</i>	
	per cent.		per cent.
Bent (<i>Agrostis</i> spp.)	.. 47	Woolly Softgrass (<i>Holcus mollis</i>)	.. 32
Sheep's Fescue (<i>Festuca ovina</i>)	22	Wild White Clover (<i>Trifolium repens</i>)	.. 12
Tufted Hairgrass (<i>Aira caespitosa</i>)	.. 6	Heath Bedstraw (<i>Galium saxatile</i>)	.. 20
Cocksfoot (<i>Dactylis glomerata</i>)	20	Mouse-eared Chickweed (<i>Cerastium</i> spp.)	.. 10
Miscellaneous	.. 5	Daisy (<i>Bellis perennis</i>)	.. 13
		Plantain (<i>Plantago</i> spp.)	.. 8
		Miscellaneous	.. 5
	100		100

It is observed that the herbage of closely mown grass land differs considerably from that of consolidated ground. While light is of vital importance in the case of *Trifolium repens*, it can be relegated to a secondary position as far as the other species are concerned.

Consolidation of the Soil.—It was thought that the consolidated condition of the soil might play some part, as the condition might be favourable to the development of some species and not to others. An experiment was carried out by the writer, to test this theory, in the following manner:—The chief species concerned were grown in flower pots, both separately and in association. One set was grown in consolidated soil, the other in loose soil. The soil was from the same source in both cases. The experiment was repeated in a garden border, part of each plot being consolidated to varying degrees, and the remainder left loose. All the plants were undisturbed during their growth.

In all cases the plants from the consolidated soil were about half the size and weight of those from the loose soil, and it was notable that the root development was very poor in the former case.

It is a popular idea that the dominance of clover on a headland in a field of "seeds" is due to consolidation. In the opinion of the writer this is a fallacy, the factor at work in this case being light. The headland is at the edge of the field where, though the crop may be shaded to some extent by the hedge, light nevertheless penetrates because the sown crop is thin. The same phenomenon may be observed in other parts of the field where the nurse crop is thin.

The evidence showed very clearly that consolidated soils are not in themselves beneficial to any species.

Resistance to Injury.—The final factor to be considered is that the peculiar structure of the dominant species on the consolidated parts enables them to resist injury by treading. It is a striking fact that all these dominant graminous species have a folded leaf section, in contrast to the rolled leaf of the other species. The leaves and their sheaths are consequently flat and offer a flat surface to the crushing action of treading. They are also able to assume the rosette habit of growth.

Another notable feature is that the basal nodes, which give rise to the growing parts of the leaf and stem, are situated well below the surface of the earth, and this in marked contrast to the species most injured by treading. A longitudinal section, cut with a sharp knife, will reveal this fact very strikingly in the case of *Lolium perenne*, a grass which on first sight appears to be well above the ground.

In most of these species, the rootstock is woody, and in the case of *Dactylis glomerata* and *Plantago media*, an experiment showed that the treading actually stimulated the growth of woody tissue. The fact may be demonstrated by cutting a longitudinal section through a plantain grown on a well trodden footpath and contrasting it with one from a loose soil.

A further experiment was carried out by the writer to test the theory of resistance to injury. The following grasses were grown in separate and repeated strips:—*Poa pratensis*, *Dactylis glomerata*, *Lolium perenne*, *Anthoxanthum odoratum*, *Alopecurus pratensis* and *Agrostis vulgaris*. The ground was then utilized as a garden path and trodden daily. *Poa pratensis* assumed a low dense habit, *Dactylis* and *Lolium* were suppressed in growth, but persisted. The three remaining species were exterminated by the treading.

The resistance of the various species to degrees of consolidation may be seen in any gateway to a pasture. There is a bare patch between the gateposts where the treading is too severe for any plant. This is followed by a zone of *Plantago*

spp. and possibly Knotgrass (*Polygonum aviculare*). Beyond this is an association of *Poa spp.* and *Lolium perenne*, followed again by *Trifolium repens*. Further out in the field the herbage may be benty and matted.

Characters of Certain of the Plants.—As *Poa pratensis* is the dominant grass in most cases, a discussion of its characters may be of interest. The structure of the leaves is worthy of consideration. They are short and strong, and at the same time concave in cross and longitudinal sections. Observation after treading upon the growing plant gives the impression that the leaves are specially adapted to allow them to spring back into place, the ability to do so being more marked than in any other species. Profuse seeding may account for the readiness with which the plant appears, but this is not more marked than in the case of *Poa annua*. The runners may help to penetrate into unpopulated regions, but other stoloniferous plants, equally well equipped, do not persist on consolidated soils.

Poa annua is not able to resist treading owing to its delicate foliage. Its presence may be explained by its extremely transient nature which enables it to occupy the ground between the periods of consolidation. This plant may also dominate small hollows or spaces between cobblestones where it escapes treading.

Poa trivialis was never observed in any quantity in any of the examples. The reason for this cannot be accounted for by the writer.

Trifolium repens is able to withstand consolidation in virtue of its tough creeping stem and woody rootstock, but it is not resistant to defoliation and may be found almost denuded of leaves.

Summary.—It seems apparent that the primary factor inducing the changes in the herbage, brought about by consolidation, is the eradication by injury of the species not structurally adapted to resist treading or crushing by implements, and the advent of species which are so adapted.

It is further evident that consolidation restricts the development, even of the species adapted to it, and, if carried to an extreme, will result in their extermination. The zonation of herbage around a gateway indicates that species exhibit varying degrees of resistance. If the operation is adapted to agricultural practice, either by mechanical means or by close treading by stock, the limits of severity must be studied.

In experimental work, close mowing is not a true imitation of close grazing, as in the former case there is no consolidation by the hoof. This is instanced by the example of the herbage of established lawns, whether they have been manured or not.

MARKETING NOTES

National Mark Egg Scheme.—During the five months March–July, 1930, the total output of eggs from the authorized packing stations was 111 millions, of which 79 millions were packed under National Mark labels. Production is now decreasing, however, with the result that prices have been very firm during the past few weeks. A considerable proportion of the eggs received at packing stations at this time of the year are of inferior quality and unfit for packing under the National Mark. Where the producer is paid for supplies on “grading out” results at the packing station, no loss is incurred by the packing station or by other producers supplying the station if any individual producer offers inferior eggs for grading and packing, but in the case of packing stations who buy on a flat rate, the lower value of inferior supplies becomes a charge on all producers supplying the station, with the result that producers of first-quality supplies are at some disadvantage. The only sound method of paying the producer is on the basis of “grading out” results.

Poorness of quality at this season may be caused by holding for a rise in prices ; it may also be due to a variety of other causes, including exposure of supplies to heat and strong light, and the debilitated condition of laying stock, which is often the result of faulty management.

The National Mark Egg and Poultry Trade Committee at their meeting on August 13, 1930, following a discussion on the present position and future developments of the National Mark Egg Scheme, unanimously passed the following resolution :—

“The National Mark Egg and Poultry Trade Committee feel that the time has arrived when they should submit their opinion on the marketing of eggs under the National Mark to the Minister of Agriculture and, through him, to the Government. When the marking of all imported eggs came into force it was acknowledged by every producer that unless some steps were taken to raise the general standard of the British supplies, and by doing this to inspire confidence among buyers by eliminating the inconvenience and risk attaching to the purchase of ungraded supplies, the marking of imported eggs might tell against instead of in favour of British eggs. To meet this difficulty the National Mark was instituted and packing stations were licensed to use the Mark. Some 150 packing stations are licensed by the National Mark Committee.

The Committee, through experience gained in dealing with the packing stations, have arrived at the following conclusions :—

- (1) The National Mark has raised the standard and quality of the British egg.
- (2) The National Mark has raised the general price of British eggs to the producer.
- (3) It has given confidence to large-scale buyers who need a standardized and reliable product in substantial quantities.
- (4) It has taken the British egg into large consuming centres where very few, if any, home produced eggs were previously sold.
- (5) With the publicity secured for the scheme and the higher standard of British eggs it has increased the demand and price for home-produced eggs.

Notwithstanding these favourable results, the Committee feel that unless some drastic steps are taken to guard the good work already done the movement may not continue to go forward in the manner desired.

The Committee, therefore, feel that some action should be taken to counteract the difficulties which are besetting the National Mark scheme so far as eggs are concerned.

The principal difficulties are set out in the paper which was read by the Head of the Markets Division of the Ministry at the World's Poultry Congress.

Having surveyed the position from all its aspect the Committee consider that it would be useful if consideration were given by the Minister and by the various organizations concerned to the possibility of legislation which will make the reform of egg marketing a permanent and accomplished fact."

National Mark Beef.—The number of sides (including quarters and pieces in terms of sides) of beef graded and marked with the National Mark for the four weeks ended August 16, 1930, was as follows :—

<i>Week ended</i>				<i>Select</i>	<i>Prime</i>	<i>Good</i>	<i>Total</i>
				LONDON			
July	26	..	..	555	643	22	1,220
August	2	..	..	482	640	42	1,164
"	9	..	..	600	833	36	1,469
"	16	..	..	496	944	32	1,472
				BIRKENHEAD*			
July	26	..	..	128	338	1	467
August	2	..	..	54	376	—	430
"	9	..	..	38	406	—	444
"	16	..	..	57	377	—	434

* Sides consigned to London.

<i>Week ended</i>				<i>Select</i>	<i>Prime</i>	<i>Good</i>	<i>Total</i>
				SCOTLAND*			
July	26	..	..	2,112	436	—	2,548
August	2	..	..	1,928	421	—	2,349
"	9	..	..	1,776	498	—	2,274
"	16	..	..	1,924	466	—	2,390

TOTAL LONDON SUPPLIES (*All Sources*)

July	26	..	..	2,795	1,417	23	4,235
August	2	..	..	2,464	1,437	42	3,943
"	9	..	..	2,414	1,737	36	4,187
"	16	..	..	2,477	1,787	32	4,296

BIRMINGHAM

July	26	..	..	18	111	25	154
August	2	..	..	30	104	22	156
"	9	..	..	31	95	6	132
"	16	..	..	36	114	7	157

* Sides consigned to London.

August is always a quiet month in Smithfield Market, owing to the holiday season. Nevertheless, sales of National Mark beef have remained satisfactory, but there was some decline in price during the month. An increased quantity of Birkenhead-killed beef was on the market, not all of which was marked. The indications are, however, that a higher percentage of this beef will be marked in the coming month, since so many retailers are asking for National Mark beef.

Some improvement has taken place in the Birmingham situation.

Preference for the "Select" grade continues. Supplies reaching this grade are readily absorbed, indicating that farmers who aim at supplying the Smithfield Market should concentrate on the type of cattle which can be brought up to the "Select" standard. It is still the case that graders are obliged to put into the "Prime" grade many cattle of inferior conformation which in other respects might have been graded "Select." In view of the difference in price between the two grades, the importance of correct breeding cannot be over-emphasized.

It is of interest to note that the United States Department of Agriculture has announced that the Government beef grading and marking facilities, which are at present available at Boston, Chicago, Topeka, Kansas City, New York, Omaha, Philadelphia and Washington, were, in July, 1930, extended to Buffalo, Cleveland, Detroit, Erie and St. Louis. As in Great Britain, the service is carried out by experienced beef graders and a similar roller stamp is employed. Beef carcasses

and pieces in the United States are marked according to quality in the following grades : U.S. Prime, U.S. Choice, U.S. Good, and U.S. Medium. A small charge is paid by the trade for the grading and marking service.

The United States scheme was started in May, 1927. During the first five months of 1930 there was an increase of 62 per cent. in the quantity of beef graded and marked compared with the corresponding period in 1929. The Department states that it receives an increasing number of requests for grading and marking from slaughterers, wholesalers, retailers and hotels and restaurants.

National Mark Apples and Pears.—With the arrival of the apple and pear season, many inquiries have been received, and additional growers have been enrolled in the National Mark Scheme. Amendments to this Scheme, which have been made in the light of experience of the first two years of working, necessitated the revision of Marketing Leaflet No. 7 ; copies of this, as revised, may now be had on application to the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W.1. The principal alteration is in relation to dessert apples, of which only " Extra Fancy " and " Fancy " may now be packed under the Mark, " C " grade being excluded.

National Mark Strawberries.—The season which has now closed was remarkable in that the early and main crop varieties of strawberries came on to the market almost simultaneously and caused something approaching a glut. National Mark fruit, however, was in excellent demand and commanded good prices. Although this was the first season of the Scheme, a gratifying measure of success was attained, and general satisfaction has been expressed.

National Mark Cherries.—Growers who were authorized to apply the National Mark to cherries have had a similar experience to the strawberry packers, in that although fruit was very plentiful, National Mark packs commanded good prices and sold well. The Ministry is confident that the Scheme will lead to a steady increase in the grading of this fruit. The attention of growers has been drawn to the desirability of the use of small non-returnable packages in order to meet modern retail requirements.

National Mark Canned Fruit, Peas and Beans.—The Minister has appointed Mr. W. P. Seabrook to be an additional member of the National Mark Canned Fruit Trade Committee, as a representative of fruit growers.

The following London firms have been added to the list of authorized canners :—

Army & Navy Co-operative Society, Ltd., 105 Victoria Street, S.W. 1.

Crosse & Blackwell, Ltd., Soho Square, W.1.

It is now certain that the National Mark will be applied to many millions of cans of home-grown fruits, peas and beans during the present season.

National Mark Wheat Flour.—It is just a year since the first “Marketing Note” on the wheat-flour scheme appeared in these pages. No estimate can be given of the total quantity of National Mark flour milled and sold since that date, but it is known that the output during the first six months of the present year exceeded 100,000 cwt. This amount is, of course, only a fraction of the national consumption of flour during the same period, and even of the total flour milled from English wheat. What is of greater significance is that the bulk of the National Mark flour has been milled by a comparatively small number of millers, who are able to judge from the steadiness of the demand that their customers find the product satisfactory.

The maintenance of the quality standard is of supreme importance to the Scheme, and the technical skill of the “authorized millers” provided the Wheat Flour Trade Committee, from the outset, with a *fair average quality standard* of National Mark flour which has enabled the product to hold its own in comparison with the finest flours of other grades. This standard has been rigorously maintained by the Trade Committee, and National Mark flour, therefore, is not open to any criticism on the ground of quality ; in fact, some millers have thought that the standard is too high.

Suggestions for amending certain details of the scheme have been made and have received careful consideration by the Trade Committee and the Ministry ; but the preponderance of evidence has shown that the scheme, with its ban on bleaching, chemical treatment and extraction of patents, and its insistence on the use of sound well-cleaned wheat, has provided a solid basis for a workable system of standardization of flour produced from home-grown wheat.

National Mark Malt Products.—The following firm has been enrolled in the scheme as authorized makers, and has joined the National Mark Malt Products Association :—

Shardlow Malt Extract Co., Ltd., Shardlow, Derby.

Publicity for National Mark Produce.—One National Mark Week was held during the month of August, viz., that at Barnstaple, at the time of the Millenary Celebrations held in that town, August 8–16. Arrangements are well forward for the holding of further National Mark Weeks in the late summer and early autumn at Hereford (Sept. 5–11), Bedford (Sept. 22–27), Bradford (Sept. 24–Oct. 4), Watford (Sept. 29–Oct. 4), Southampton (Oct. 4–11), Llanelly (Oct. 7–16), and Cambridge (Oct. 27–Nov. 1).

Plans for advertising National Mark produce on a wider basis during the autumn and early winter have been formulated. Experience in connexion with National Mark Weeks already held indicates that there is a strong preference among consumers for home produce, provided that it can be readily recognized as such and that its quality is good; the time is therefore ripe for the National Mark—what it is and what it represents—to be brought more prominently before the public. Arrangements to this end are in hand, and, at the same time, publicity is in contemplation designed to bring home to producers and distributors the part they can play in the production and distribution of increasing quantities of well-graded and well-packed home produce of guaranteed quality under the National Mark.

Following the experiment of advertising National Mark beef, tomatoes and cucumbers, and eggs on London omnibuses for four weeks in midsummer, it has been decided to advertise National Mark beef, canned fruit, canned peas, and malt extract with cod-liver oil in a similar manner for a period of 15 weeks commencing in mid-September.

National Mark Booklet.—The Ministry has recently issued a second edition of the National Mark booklet, which contains a brief outline of the objects and scope of the National Mark scheme for the better standardization and marketing of home agricultural and horticultural produce, together with a statement of its advantages to producer, distributor and consumer. The booklet also gives a short description of the scheme in its special application to the following home-produced commodities which, according to season, are now sold under the National Mark: apples, pears, tomatoes, cucumbers, strawberries, cherries, canned fruits, canned peas and beans, eggs, dressed poultry, all-English wheat flour, malt products, and beef (the last in London and Birmingham only). Copies of the booklet may be obtained, free of charge, on application to the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W.1.

Marketing Demonstrations.—Two demonstrations are to be given by the Ministry during September, namely :—

Bucks County Show at Waddlesdon Sept. 4 National Mark Hall.

Frome District Agri- at Frome field, Sept. 24 Cheese.
cultural Show. Frome.

The cheese-marketing demonstration, shown for the first time at the Royal Show, Manchester, illustrated the lines on which the National Mark might be applied to cheese.

An exhibit of four cheeses of varying fat-content suggested that a guarantee might be given by the producer that whole milk only had been used in the manufacture of cheese intended to bear the National Mark. This guarantee could be applied by means of casein plaques or discs bearing (a) the words "Guaranteed made from whole milk"; (b) a serial number identifying the maker; and (c) a code signifying the date of manufacture (see Fig. 1). The ultimate test to ascertain whether whole milk had been used would be the analysis of the cheese, it being assumed that a minimum fat percentage of 45 per cent. in the moisture-free substance indicates the use of whole milk. A chart of the results of 65,000 analyses made in Holland of whole-milk cheese showed that the percentage risk of failure to secure this proportion of fat was only 0.5 per cent. Up to this point, the exhibit was described as Stage 1.

Stage 2 dealt with the application of the National Mark to cover the other quality features of cheese, namely, flavour, texture and body, colour and appearance. An exhibit of several cheeses which had developed defects of quality in one or other of these respects since purchase from the producer emphasized the importance of delaying the application of the National Mark to within a few days of the cheese being dispatched to the retailer. By so doing, the risk of deterioration after marking would be reduced to a minimum.

Two grades of cheese were suggested, namely, "Selected" and "Selected Mature"; in both cases the cheese would be required to conform to quality standards laid down for the appropriate grade, and, in the latter case, might be required to have reached an age of three months since manufacture; moreover, the National Mark and grade would be applied only to cheese which bore the producer's plaque guaranteeing the use of whole milk in manufacture.

A possible method of application by means of a blow-lamp branding instrument was demonstrated (see Figs. 2 & 3); this instrument makes a mark on the outer bandage and a suffi-

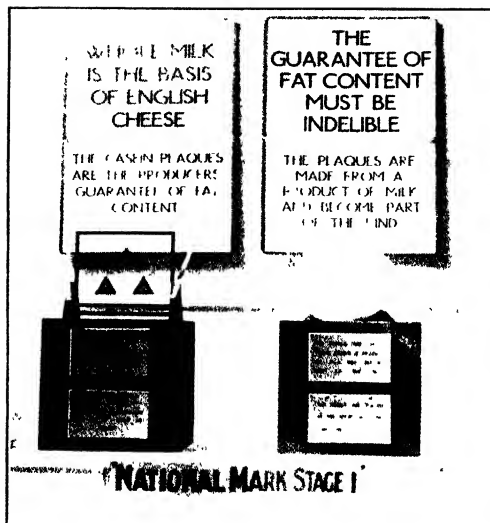


FIG. 1. Casin plaques or discs to certify manufacture from whole milk.

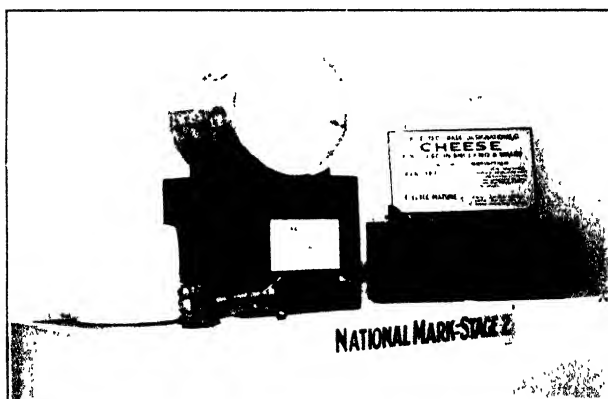


FIG. 2. Application of the National Mark by blow lamp branding instrument.



FIG. 3. Showing mark made by means of blow lamp branding instrument.

METHODS OF APPLYING THE NATIONAL MARK TO CHEESE.
(See page opposite.)

ciently deep indentation in the rind for it to appear when the bandage is removed. The brand demonstrated consisted of the National Mark, the registered number of the authorized user of the branding instrument, and letters signifying the grade.

The demonstration also included an exhibit of home-produced and imported cheese showing the various methods that are now adopted for grading and trade-marking cheeses of different varieties and types.

A feature of interest was a cheese-judging stand, where the public were invited to sample and express their opinion on the relative merits of three Cheshire and three Cheddar cheeses of different qualities. In the course of time some interesting records should be obtained in this way.

The whole exhibit aroused much interest among producers and distributors, the proposals for applying the National Mark being much discussed and meeting with general approval.

Economic Series.—The demand for this series of marketing reports is still keen, 1,069 copies having been sold, so far, at the Ministry's marketing demonstrations this year. A full list of the Series can be had on application to the Ministry.

Marketing Grants.—From funds made available by the Empire Marketing Board for the improvement of marketing of agricultural produce, the Ministry, from time to time, makes certain grants to educational and other bodies in order to assist marketing investigations and experiments.

The following grants were made during 1929 and the first six months of 1930. Those marked with an asterisk are in continuation of grants previously made (see p. 1190 of this JOURNAL for March, 1929).

<i>Amount</i> (<i>Not exceeding</i>)	<i>To whom paid</i>	<i>Purpose</i>
1929		
£42 for one year	Wiltshire Egg Producers, Ltd.	To provide costings data in respect of egg packing station
" " "	Norfolk Egg Producers, Ltd.	" " "
" " "	Cumberland Poultry Farmers, Ltd.	" " "
" " "	Melton Mowbray and District Farmers' Assn.	" " "
*£688 (Academic year July, 1929— June, 1930.)	Agricultural Economics Research Inst., Oxford	For extension of the study of marketing farm products.
*£175	Pershire Co-operative Fruit Market.	Third and fourth years of a grading experiment.

<i>Amount (Not exceeding)</i>	<i>To whom paid</i>	<i>Purpose</i>
1929		
*£800 (Academic year October, 1929— September, 1930.)	Cambridge University.	Pig-recording scheme in conjunction with St. Edmundsbury Bacon Factory.
*£194 7s. 4d. 4s. per ton offered for 1930 season.	Norfolk Fruit Growers, Ltd.	To meet cost of inspection of graded black currants marketed under an experimental scheme.
*£300	Gloucestershire Market- ing Society, Ltd.	To meet additional costs incurred while acting as a demonstration egg packing station.
*£552 (Academic year October, 1929— September, 1930.)	University College of Wales.	Marketing investigations.
*£125 (additional)	University College of Wales.	Statistical investigations relating to marketing.
*£218 2s. 0d.	National Institute of Agricultural Botany, Cambridge.	Expenses in connexion with the testing of seeds for export.
£250	Clynderwen and District Farmers' Association.	To meet additional costs incurred while acting as a demonstration centre for egg-packing.
£75	Devon Butter Producers' Association.	To assist a scheme for the better marketing of Devonshire butter.
1930		
£125	Midland Agricultural College, Sutton Bonington.	Investigation into the distribution and consumption of meat and fresh-meat products in the town of Loughborough.
£15	Somerset Beekoopers' Association.	Towards expenses of grading experiment.
£800	National Mark Egg Central, Ltd.	To assist establishment of a central federation of egg packing-stations.
£100	Littleton and Badsey Growers, Ltd.	Towards certain additional costs incurred in connexion with an asparagus grading pool.
£85	University College of N. Wales, Bangor.	Investigation into the marketing of washed and unwashed Welsh wool.

Cheaper Maize for Poultry Feeding in Germany.—The Maize Department of the Reich has now commenced the maize campaign, decided upon in May and recently approved by the

Reichsrat, by which poultry keepers who comply with the regulations for the delivery of fresh eggs to the recognized co-operative societies or collecting stations will receive coupons entitling them to draw supplies of monopoly maize at favourable prices. Recognized poultry breeders will also have similar facilities for obtaining cheap maize. For every 100 eggs delivered or for each hen bred in the year, the farmer concerned will receive 15 kg. maize. The campaign is expected to assist the general tendency towards standardization in the poultry industry, as farmers who do not comply with the regulations of the egg-marketing scheme will not have an opportunity of drawing supplies of cheap maize.

Poultry Shaping and Cooling Plant.—A system of shaping and cooling poultry in special trolleys was demonstrated on one of the Ministry's stands at the recent World's Poultry Congress at the Crystal Palace.

Under this system a trolley fitted with six troughs of the usual V-shape (see Figs. 1 and 2) is packed with poultry in the plucking room. The pressure necessary for shaping is applied by means of boards running lengthwise along the troughs and adjusted to give the required pressure by means of spring catches (AA). The trolleys illustrated were constructed for the Ministry by the Gloucestershire Marketing Society. As soon as it has been filled with poultry, the trolley is wheeled to the cooling room, where it is connected by a rubber hose to a small air compressing plant. Air at a pressure of from 20 to 30 lb. per sq. in. is led to six pipes (B.B), one fitted above the back edge of each of the shaping troughs. A series of small holes, say ten of $\frac{1}{8}$ in. diameter for a trolley 4 ft. 6 in. long, is provided in each of these pipes, so that the compressed air is directed obliquely downwards on to the poultry between the back of the trough and the pressing board, giving a steady flow of cool air around and between the birds. Each of the horizontal pipes is fitted with a stop-cock for purposes of regulation, and provision is also made for adjusting the tilt of the pipes so that any necessary alteration may be made to ensure the air jets striking the birds at the angle which will give the best results.

In practice, it is found that with the ordinary water-jacketed type of compressor, the air issuing from the jets is about 6° F. cooler than the air drawn in by the machine, and this allows of the birds being efficiently cooled in a comparatively short time. In addition, it is possible, if very quick cooling

is necessary, to cool the air while it is under pressure and so ensure very cold air after expansion at the jets.

Means are provided for filtering the air to remove all dust and excess moisture before it is allowed to come in contact with the birds.

The Ministry would be glad to answer inquiries regarding this apparatus from poultry farmers or packers who may be interested.

The Agricultural Marketing Bill.—*Need for Large-scale Marketing Organization.*—The marketing of home agricultural produce is distinguished by extreme individualism, the effects of which are discernible in the lack of harmony between supplies and market requirements both as to quantity and quality. The ultimate purpose of marketing organization in home agriculture as in other industries must, therefore, be the efficient adjustment of supplies, quantitatively or qualitatively, or both, to the demands of the market. This necessarily involves a comprehensiveness of plan and unity of execution such as can only be secured in the case of each home-produced commodity, or group of related commodities, by a body, whether trading or non-trading, which is able to regulate the marketing of home supplies as a whole, or, according to circumstances, the supplies of a particular area, and to exercise a conscious control of such supplies at the source.

Present Weaknesses.—The weaknesses of the present position are obvious. There is, for example, no large-scale marketing organization of home producers which is in a position to deal effectively with actual or potential surpluses in the case of milk, potatoes and hops, respectively, and it will be generally agreed that if the possible disorganization of the milk market, or a recurrence of bad years for potatoes* and hops, can be avoided and more stable market conditions secured by the all-embracing organization of the producers of these commodities, the effort should be made forthwith.

Milk.—In the case of milk, it is common knowledge that the price-negotiations conducted annually between the representative bodies of producers and distributors in England are tending to lose effect through the lack of that completeness of organization at the producers' end which only legislative backing can secure. The volume of milk offered to the fluid market is nearly always in excess of the consumptive demand and, in consequence, those producers who have difficulty in finding a market seek to overcome the difficulty by underselling.

* Such as the crop years 1928 and 1929.

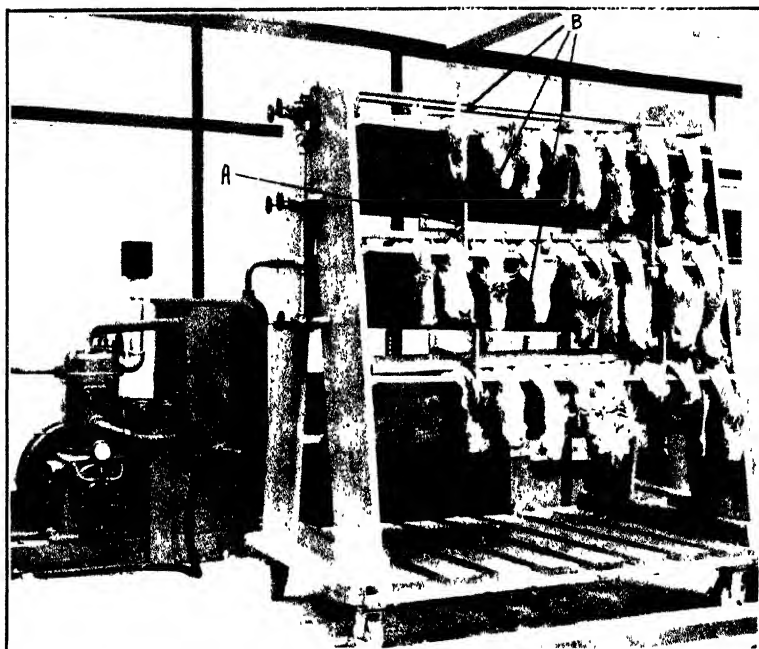


FIG. 1. General view of the trolley and air compression plant. A—Spring catches; B—Air pressure pipe.

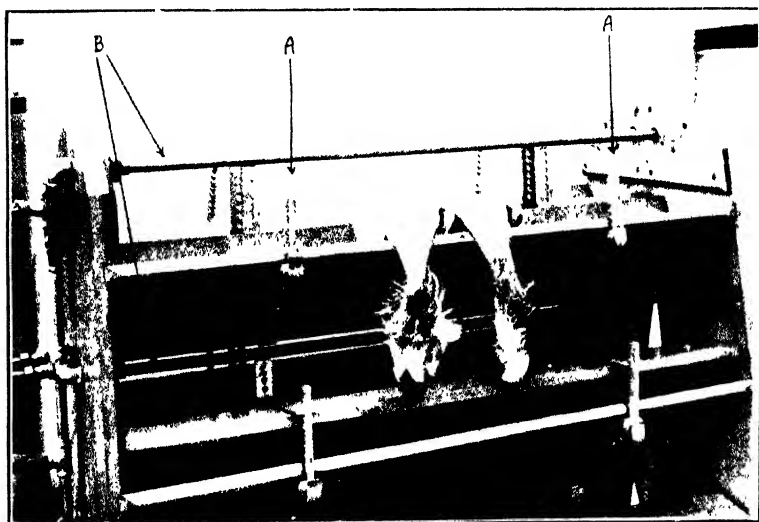


FIG. 2. Detail view, showing spring catches (A—A) and air pressure pipes (B—B).

POULTRY SHAPING AND COOLING PLANT—EXHIBITED IN OPERATION
AT THE WORLD'S POULTRY CONGRESS, 1930

A large-scale organization of producers, endowed with authority to secure the adherence of milk producers as a whole, and to require, *inter alia*, the registration of sale-contracts, would be in a position to protect the livelihood of all milk producers and to guarantee to distributors, whether consumers' co-operative societies or otherwise, that any price or other agreements entered into on behalf of its constituents would be duly and effectively observed. Precisely how such an organization would function in practice, in regard, for example, to the mobilization of funds from which to pay compensation for the manufacture of surplus milk into less valuable products, and to defray the cost of milk publicity, would be a matter for consideration.

Potatoes.—In the case of potatoes, it was not open ports but the inability of producers, in their present disorganized state, to deal effectively with a surplus, which caused the disastrous conditions from which potato growers have suffered in the last two seasons. When a surplus occurs, growers sustain enormous losses through low prices without consumers deriving any commensurate advantage. The problem of the recurring surplus can only be dealt with on national lines, and the organization of potato growers on a national scale is essential before any progress can be made. A surplus arises from wide variations in the annual *yields* per acre and its effect on price is altogether disproportionate to its extent. A large-scale organization of potato growers need not actually buy and sell the crop. Although its operations would naturally tend to economy in distribution costs, to the advantage of both producer and consumer, it might, to begin with, devote its energies primarily to diverting surplus stocks of potatoes into manufacturing channels for dried cattle-food, acetic acid, farina, etc., and develop export markets. The growers would, of course, need to provide funds for this purpose. A policy of this kind would lead to a considerable degree of price stabilization and, without detriment to the consumers' interests and in spite of competition from free imports, farmers should secure better cash returns on the average than they do in present circumstances.

Hops.—The hop-growing industry is also afflicted with the problem of a surplus. A hop growers' organization—English Hop Growers, Ltd.—was in operation for four years from 1925 to 1928 inclusive. To begin with, the organization had over 90 per cent. of the hop growers as members, but owing to storage and other charges involved in an orderly marketing policy,

some growers found that they could do better by joining the minority outside the organization and membership began to fall off. Eventually, owing to the gradual weakening of its control over the market, the society was compelled to discontinue operations. Since then, in spite of the existence of an import duty of £4 per cwt., home-grown hops have made only about £3 per cwt. on an average, and many are unsaleable. Until there is a large-scale organization endowed with compulsory powers in regard to any outstanding minority, it will be impossible to put the hop-growing industry on a sound economic basis.

General.—For nearly all home products, whatever the circumstances of production and marketing, there is, in fact, scope and need for a regulating organization to undertake the methodical feeding of the market according to a coherent plan. Such an organization, in complete control of supplies, would be in a position to extend adequate marketing credit to producers—a most important facility; it would aim at lowering the cost of distribution by eliminating unnecessary risk and waste and, with this object in view, it would, as far as practicable, not only offer a standardized article to the distributive trades, but regulate the flow of produce to market both as to time and place; it would be in a position to develop inter-trading relationships with the vast organization represented by the consumers' co-operative movement; it would be able to negotiate the terms and conditions under which its produce is handled at all stages; it could undertake national advertising and co-operate with wholesale and retail distributors generally in securing the most effective methods of shop display and sale.

The fact that most home products have to face the competition of imports and that, in such cases, the home producer can have little or no say as regards price, does not detract from the merit or necessity of this policy, which aims at securing that the home-produce tributary of the market stream shall, at its source, be under the same kind of unified control—whether of quality alone or of the time, rate and place of marketing—as that commonly exercised over imported supplies by overseas boards and other organizations which supply our market.

Minorities must be brought into Line.—While the need for action is generally admitted, the task of building up an effective organization on voluntary lines would be formidable. The task of holding together such an organization when

formed would be even more formidable so long as a minority of producers can stand by and leave others to carry the load which should, in fairness, be spread evenly over all. As shown by the experience of English Hop Growers, Ltd., a willing majority cannot, in fact, afford to be bound by a scheme which is being exploited by a minority. In the interests of producers as a whole, a dissident minority must be brought into line.

The Policy of the Bill.—The Agricultural Marketing Bill, which was introduced into the House of Commons on July 31, 1930, makes possible the large-scale organization of producers in the manner and for the purposes broadly indicated above. In preparing the Bill, for which there are precedents, as to type or principle, in the British Dominions, it was fully appreciated that farming opinion does not seek a remedy such as will involve direct regulation by the State. Through the Bill, the Government has, therefore, sought to provide the agricultural industry with machinery which is clearly needed—indeed, its provision, in some form or another, is inevitable—on the marketing side, but which the various commodity industries that make up the industry of agriculture may use or not at their discretion and to the extent that circumstances may require. The Bill is, therefore, optional inasmuch as it is for farmers, themselves, to submit the schemes which, if approved, will be mandatory on the producers concerned. The Bill, in effect, provides a legislative background of which farmers may make such use as they will, on their own initiative, to regulate the marketing of their own produce, either locally or nationally. It authorizes self-discipline, but its sanctions may only be applied by farmers to farmers. It creates no new criminal offences, since it does not permit of external disciplinary action of any kind against producers or any other section of the community.

Safeguards for Consumers and Others affected.—The Bill, which applies also to Scotland, confers wide powers upon organized farmers, and though these can only be applied by farmers to farmers yet their application cannot be without effect upon other interests. Great care has, therefore, been taken to provide public safeguards, particularly for the great body of consumers, and not excluding any minority of producers that may be involved. Such safeguards are definitely in the interests of organized farmers and are, in fact, desired by the more enlightened.

Marketing Funds: Government Assistance.—Provision is

also made in the Bill for the creation of Marketing Funds for which Parliament is asked to provide a sum of £625,000, from which both short-term and long-term loans may be made to boards set up by producers to administer commodity marketing schemes. It is anticipated that the more pressing need of these boards will be for initial funds with which they can make a quick start, and accordingly the Bill provides for the short-term loans to be free of interest, a concession which will be appreciated.

Conclusion.—The Government fully appreciates the significance and general economic importance of the standardization schemes for home produce which have been made possible by the Agricultural Produce (Grading and Marking) Act brought forward by the previous Government in 1928. Since the present Government came into Office, new schemes have been introduced under the Act and financial provision has been made for publicity for the standardized products. Standardization cannot, however, be made fully effective without organization; the two are, in fact, complementary. The Government, by the Agricultural Marketing Bill, is seeking to extend the horizon and to prepare the way for a great forward movement towards the goal of efficient marketing.

* * * * *

THE BACON INDUSTRY

THE Minister of Agriculture and Fisheries, in issuing the following Report of the Pig Industry Council, hopes that it will secure the same wide publicity as was accorded to the Council's two previous Reports.

The Council considers that internal reform or organization of the industry is dependent upon and subsidiary to a scheme for restricting imports. The restriction of imports is, of course, contrary to the terms of the Geneva Convention and to our treaty obligations. In any event, while it is possible that, under a restriction scheme, bacon factories might have bigger supplies of bacon to offer, there is no reason to believe that they would have less irregular supplies unless some steps were taken to counteract the tendency to fluctuation in the pig population to which the pig industry is universally prone. In the Minister's view, organization of the industry is, therefore, the first necessity, whether or not restriction of imports, or a system of bulk purchase, is within the bounds of practical politics.

Even as it exists to-day, the Minister believes that substantial improvements can, in fact, be effected in the

pig industry, and that, as was suggested by the Council in its second interim report, economies can be achieved in production, marketing and manufacture. Further suggestions by the Council on this question will, therefore, be welcomed by the Minister, who is warmly appreciative of the valuable work towards this objective which the Council has already accomplished.

Report to the Minister of Agriculture and Fisheries by the Pig Industry Council.—In publishing the second interim report of the Pig Industry Council,* the Minister stated that he could not be “held to endorse any suggestions therein involving any prohibition or restriction of the importation of articles of food ;” but that he had asked the Council “to continue with the task of exploring and assessing the economies which the pig industry can secure of itself, of recommending such action by the industry as will, in fact, secure these economies, of investigating the economic environment of competing bacon industries abroad, and generally pointing the way to a higher all-round standard of efficiency at home.”

The Council now respectfully urges upon the Minister further consideration of the imperative need for some measure of control, regulation or restriction of imports of bacon. In the absence of such measure, the production of bacon pigs, no matter how highly organized or efficient, can only remain uncertain, and as a result the country will be faced with the virtual elimination of its home bacon trade.

Attention to all the advice the Council might be able to offer would afford no reasonable security that, after working for a year to breed and fatten a litter of pigs, the farmer would not have to suffer a substantial loss on his output owing to the flooding of the English market with imported bacon. The Council meets with this difficulty in every phase of its investigation.

The Council views with great alarm the position of the industry. Owing to the above-mentioned lack of reasonable security and to economic conditions, killings of English bacon pigs in 13 representative factories, during the first four months of 1924, 1925 and 1926, averaged only 46·5 per cent. of capacity. In the same period in 1927, 1928 and 1929, this figure decreased to 32·1 per cent. Taking the figures for the whole year, in 1924, 1925 and 1926, the average killings used only 52·2 per cent. of capacity, and in 1927, 1928 and 1929,

* Marketing Leaflet No. 16.

only 41.3 per cent. of the capacity of the same factories. Under these conditions no factory can be run economically, and this reacts to the disadvantage of the producer and consumer alike.

Though these figures show a greatly decreased production of English bacon, consumption has increased and has been met by adequate supplies of imported bacon. That these supplies of foreign bacon are almost certain to be increased is proved by the following extract from a statement by the Chairman at the Annual Meeting, on March 21, 1930, of Delegates from the Danish Co-operative Bacon Factories, taken from the *Andelsbladet* of April 4, 1930. At this meeting the Chairman, after quoting figures showing the increase in the pig population of Denmark, as shown by a census taken at the end of 1929 and the beginning of 1930, went on to say :—

The number of pigs for export as bacon, to judge from these figures, will probably, in the course of the year, reach 120,000 to 125,000 pigs per week and the question now arises : Can we dispose of the whole of this increased quantity in England ? We hope so, and fortunately for us the pig population in England and Ireland has very considerably decreased, so much so that there is hardly any bacon production at the moment, as all the pigs can be sold as fresh pork at high prices. The English market can, no doubt, absorb somewhat more but we shall hardly escape a reduction in prices and these questions then arise : Do we do all we can to find new outlets and fresh markets ? Do we not take it too much for granted that the English market will always be ready to take the whole of our bacon production ? Ought we not already to look round and see if there are other countries to which the various pig products can be exported ? Is this not a problem for the Union* in connexion with the individual factory to take up ? Should these experiments cost a good deal in the beginning it would not be impossible for the Union to bear the expenses in connexion therewith. Everything that we can do to relieve the English market would be to our advantage.

For very many years past, as has been previously indicated, the lack of steady continuous supplies of pigs to English bacon factories has been acute. Each winter sees the bulk of available pigs slaughtered for the fresh pork market, with the result that, during the early months of each year, it is possible to secure only a small number of pigs for the home bacon trade. The consequence is that the bulk of the trade goes to our Continental competitors, who, having in this country a free and valuable market with practically no English competition, seize the opportunity further to extend their trade here.

* i.e., The Union of Danish Co-operative Bacon Factories.

The foreigner is thus increasing his hold upon the bacon trade in this country. In selling bacon, as in the case of any other article, a market can be created only by service. If a buyer cannot rely on supplies from one source he looks for another one, and having found it, he keeps it. The measure of the sale for English bacon must always depend on regularity of output.

It is now two years since the Council was constituted, and it is necessary to emphasize the principal point of its terms of reference, which are as follows :—

To consider the circumstances affecting pig production in England and Wales, with special reference to methods of marketing and to the requirements of the home market, and to make recommendations from time to time with the object of *increasing the home production both of pork and bacon.*

During the intervening period the members of the Council have met repeatedly, and a vast amount of time and labour has been devoted to discussions of breeds and types, systems of litter testing, animal hygiene, veterinary inspection, and other kindred aspects of the subject. But, although such considerations are of a certain limited value and importance, they are all dependent upon, and entirely subsidiary to, the one great essential necessary to success, and that is a sound foundation on which to build. This cannot exist without some feeling of security that efficient pig production will yield a reasonable profit.

The Council desires, therefore, to record its emphatic opinion that it is not justified in recommending any steps for the increase of pig production unless this first and most vital factor, which in its opinion dominates the whole situation, is given immediate precedence.

Having carefully and anxiously explored every avenue likely to lead to the greater and more continuous production of pigs, the Council can see one solution, and one only, likely to produce those beneficial results which its constitution was designed to secure. In the Council's judgment that solution lies in ensuring that the pig producer is not from time to time placed at the mercy of foreign competitors and compelled to market his bacon pigs at a serious loss.

This involves action by the British Government to regulate and control the import of foreign bacon and pig products, produced under economic conditions which have no counterpart in this country.

Germany has recently passed a law, the effect of which is so to raise import duties as virtually to prohibit the importa-

tion of meat supplies. Any such restriction of imports means that an ever-increasing volume of foreign products will be sent to this country as being virtually the only free dumping ground where every foreign nation is permitted to dominate our home market.

In the Council's judgment it is vital that the Government should not wait until these further threatened dangers are actually upon the country, but should move to secure the immediate increase of home-produced supplies of pigs by a reasoned and equitable system of control or restriction of foreign imports of bacon and pig products.

Hitherto the loss sustained by farmers in marketing cereals and potatoes has been one of the most potent causes of the agricultural depression from which we are now suffering. The course now recommended would provide English farmers with a sure and certain means of utilizing their grain, and of turning it to direct profit.

This Council has already expressed its opinion that it is only in the bacon trade that expansion can be looked for in the industry,* and has also given the Minister its considered estimate of the increase in employment possible by the establishment of a flourishing bacon industry.† The Council is of opinion that the measures now being urged on the Minister will not be to the detriment of the consumer, and that they are absolutely essential not only to the expansion of pig production, but even to its continued existence as an important section of the agricultural industry. The well-being of the pig industry is of vital importance to the whole agricultural community. It is hopeless to expect to set the industry on its feet and materially increase production until confidence has been established and the farmer convinced that he can have some reasonable expectation of a return for his enterprise and capital outlay. The Council, therefore, most respectfully urges the Minister to reconsider this question, and at once initiate those measures which, in the Council's view, constitute the only means of averting a disaster to that section of the agricultural industry with which the Council is dealing, a disaster which would inevitably react on the whole.

FOLKESTONE, *Chairman*,
May 21, 1930.

* Marketing Leaflet No. 16, pp. 4 and 5.

† *Ibid.* p. 8.

AGRICULTURAL RETURNS OF ENGLAND AND WALES, 1930

ACREAGE UNDER CROPS AND GRASS AND NUMBERS OF LIVE STOCK ON HOLDINGS ABOVE ONE ACRE IN EXTENT IN ENGLAND AND WALES AS RETURNED BY OCCUPIERS ON JUNE 4, 1930.
(The figures for 1930 are subject to revision.)

CROPS AND GRASS

Distribution	1930	1929	Increase		Decrease	
	<i>Acres</i>	<i>Acres</i>	<i>Acres</i>	<i>Per cent.</i>	<i>Acres</i>	<i>Per cent.</i>
TOTAL ACREAGE under all CROPS and GRASS ..	25,379,000	25,438,000	—	—	59,000	0.2
*ROUGH GRAZINGS ..	5,293,000	5,283,000	10,000	0.2	—	—
ARABLE LAND ..	9,834,000	9,948,000	—	—	114,000	1.1
PERMANENT GRASS :						
For Hay ..	5,051,000	4,696,000	355,000	7.6	—	—
Not for Hay	10,494,000	10,794,000	—	—	300,000	2.8
TOTAL ..	15,545,000	15,490,000	55,000	0.4	—	—
Wheat	1,346,000	1,330,000	16,000	1.2	—	—
Barley	1,026,000	1,120,000	—	—	94,000	8.4
Oats	1,773,000	1,854,000	—	—	81,000	4.4
Mixed Corn ..	131,300	140,400	—	—	9,100	6.5
Rye	44,300	34,400	9,900	28.8	—	—
Beans, harvested as corn ..	162,200	144,400	17,800	12.3	—	—
Beans, picked or cut green ..	13,500	12,600	900	7.1	—	—
Peas, harvested as corn ..	79,500	78,600	900	1.1	—	—
Peas, picked or cut green ..	56,200	53,900	2,300	4.3	—	—
Potatoes ..	422,600	518,800	—	—	96,200	18.5
Turnips & Swedes	671,300	699,400	—	—	28,100	4.0
Mangold ..	288,500	299,200	—	—	10,700	3.6
Sugar Beet ..	345,700	229,900	116,800	50.8	—	—
Cabbage for fodder, Kohlrabi and Rape ..	134,300	124,700	9,600	7.7	—	—
Vetches or Tares	74,600	67,900	6,700	9.9	—	—
Lucerne ..	39,800	35,800	4,000	11.2	—	—
Mustard for seed	26,000	23,100	2,900	12.6	—	—
Cabbage for human consumption ..	30,800	32,400	—	—	1,600	4.9
Brussels sprouts	26,500	26,700	—	—	200	0.7
Cauliflower or Brocoli ..	14,900	13,900	1,000	7.2	—	—
Carrots	9,100	10,300	—	—	1,200	11.7

* Mountain, Heath, Moor, Down and other rough land used for grazing.

CROPS AND GRASS—*continued.*

Distribution	1930	1929	Increase		Decrease	
	<i>Acres</i>	<i>Acres</i>	<i>Acres</i>	<i>Per cent.</i>	<i>Acres</i>	<i>Per cent.</i>
Onions	2,000	2,400	---	---	400	16.7
Celery	6,400	5,600	800	14.3	---	---
Rhubarb	7,700	7,200	500	6.9	---	---
Linseed	4,000	3,100	900	29.0	---	---
Hops	20,000	24,000	---	---	4,000	16.7
Small Fruit ..	66,200	64,900	1,300	2.0	---	---
Orchards	247,000	248,400	---	---	1,400	0.6
<hr/>						
CLOVER and ROTATION GRASSES:						
For Hay	1,594,000	1,524,000	70,000	4.6	---	---
Nor for Hay ..	830,000	845,000	---	---	15,000	1.8
<hr/>						
TOTAL	2,424,000	2,369,000	55,000	2.3	---	---
<hr/>						
BARE FALLOW ..	294,800	325,400	---	---	30,600	9.4

The area covered by the annual returns made as on June 4, 1930, by occupiers of agricultural holdings exceeding one acre in extent in England and Wales is 30,672,000 acres, revealing a net loss of agricultural land of 49,000 acres since June, 1929. The area returned as under crops and permanent grass is 25,379,000 acres, or 59,000 acres less than in 1929, while the acreage of rough grazings is 5,293,000 acres, which shows an increase of 10,000 acres. The arable acreage returned was 9,834,000 acres, and while this acreage shows a further reduction of 114,000 since last year, the decrease was appreciably less than that shown in any of the three preceding years. There was again an increase in the area under permanent grass which, at 15,545,000 acres, was 55,000 acres more than in 1929.

While the arable area has thus continued to shrink the acreage left as bare fallow was also again less than in the previous year (the reduction being 30,600 acres), so that the area returned as actually under crops in June, 1930, other than clover and rotation grasses was 138,000 acres less than last year.

The area under corn crops (including beans and peas harvested as corn) shows a reduction of 140,000 acres, a small increase in the wheat and rye acreages and in the areas of beans and peas harvested for corn being heavily outbalanced by reductions in the area under barley, oats and mixed corn. Potatoes and roots show a reduction in acreage of 96,000 acres and 39,000 acres respectively, while sugar beet shows a remarkable increase of 117,000 acres or over 50 per cent. The acreage under vegetables as a whole shows a decrease; an addition to the acreage under small fruit is more than counterbalanced by a slightly heavier decrease in orchards, and the area under hops is less by about 4,000 acres.

Cereals.—The acreage under the principal cereal crops—wheat, barley, oats and mixed corn—shows a net decrease of about 170,000 acres, a small increase in the acreage under wheat being heavily discounted by reductions in the acreage under the other three crops. The area under wheat was 1,346,000 acres, or 16,000 acres (1.2 per cent.) larger than in 1929, a small but welcome increase in view of the great shrinkage of the area under this crop in the last ten years. More

than half of the counties returned increased acreages under this crop, and these were mainly in the North Eastern, Eastern, East Midland and the two northern divisions. Norfolk returned nearly 5,000 acres more than in 1929, and Lincolnshire a net increase of nearly 3,000 acres. There was a reduction of 1,400 acres in the East Riding, but an increase amounting to 5,800 acres in the other two Ridings.

The barley acreage, which shrank by 65,000 acres last year, showed a further substantial reduction of 94,000 acres (8·4 per cent.) and at 1,026,000 acres was the smallest area ever recorded. The decrease was general throughout the country, no county of importance in regard to this crop recording any increase. The Norfolk barley area was reduced by 13,000 acres, the Yorkshire area by 9,000 acres, and the Lincolnshire area by 10,000 acres, while Essex and Suffolk returned acreages which were smaller by 7,000 acres and 11,000 acres respectively. The increase of 92,000 acres shown in the acreage under oats last year was almost eliminated by a reduction of 81,000 acres (4·4 per cent.) this year, the total acreage returned under oats being 1,773,000 acres. Practically every county in England and one-half of the Welsh counties returned smaller acreages than in 1929, the heaviest reductions being 8,000 acres in Norfolk, 5,000 acres in Lancashire, while the three Ridings of Yorkshire together lost 17,000 acres.

The area under mixed corn was 131,000 acres, which, although 9,000 acres less than in 1929, was still above the acreage of this crop for any other year since 1924. Nearly one-half of the acreage under this crop is in the South-Western division which returned a small increase of over 1,000 acres. Otherwise decreases were general practically throughout the country.

There was again an increase in the area under rye, which at 44,000 acres was 10,000 acres more than in 1929. While almost every county contributed to this increase, the most notable addition was 1,500 acres in Nottingham.

Beans and Peas.—The total area under beans was 176,000 acres, and was larger than that of 1929 by about 19,000 acres (12·0 per cent.). The increase was mainly in the area to be harvested as corn, which was 162,000 acres, or 18,000 acres more than in 1929. Larger acreages under this crop were returned by practically all counties except in the Northern and South-Western Divisions, where decreases were general. Beans to be picked green were grown on 13,000 acres, an increase of 1,000 acres (7·1 per cent.) compared with the area returned in 1929. The acreage under peas again showed an increase although rather less than that of last year. The total acreage was 136,000, the increase being 3,000 acres, mainly in the area to be picked green, which was 56,000 acres, or 2,300 acres more than in 1929. The area to be harvested as corn was 79,000 acres, or 900 acres larger than in 1929.

Potatoes.—The acreage returned as under potatoes was 423,000 acres, which was 96,000 acres (18·5 per cent.) less than in 1929, and is the smallest acreage under this crop since 1910. With one negligible exception decreases were general in all counties. The heaviest reductions were in Lincolnshire which returned 24,000 acres less than in 1929, Yorkshire with 11,000 acres less, and Lancashire and the Isle of Ely with 6,000 acres and 7,000 acres respectively less than in 1929.

Sugar Beet.—An increase of 117,000 acres (50·8 per cent.) in the area under sugar beet has brought the acreage to 347,000 acres. Except for trifling decreases in three northern counties and one in Wales increases were general throughout the country. The bulk of the increase was shown in the Eastern and North-Eastern divisions which between them returned 93,000 acres more than in 1929. The largest county increases were 28,000 acres in Lincolnshire; 21,000 acres in Norfolk;

13,000 acres in Suffolk : and 12,000 acres in the Isle of Ely. Outside these two divisions the most important increase was that of 5,000 acres in Salop.

Fodder Roots.—The area under turnips and swedes was further reduced by 28,000 acres (4 per cent.) to 671,000 acres. Except in the North-Western division where the majorities of counties showed an increase, smaller acreages were general almost throughout the country, the largest decrease being that of 6,000 acres in Norfolk. The very small increase shown in the area under mangolds in 1929 was not maintained and the area of 288,000 acres returned this year is 11,000 acres or 3·6 per cent. smaller than in 1929. The counties showing the greatest decreases were Yorkshire 1,300 acres, Salop 1,030 acres and Norfolk 1,415 acres.

Vegetables.—The majority of vegetables were grown on reduced areas, the most notable exceptions being cauliflower and broccoli which show an increase of 1,000 acres to 14,900 acres, while the acreages of celery and rhubarb were increased by 800 acres to 6,400 acres and by 500 acres to 7,700 acres respectively. Cabbage for human consumption was grown on 30,800 acres or 1,600 acres less than in 1929, while the area under brussels sprouts at 26,500 was only very little less than in the previous year. The acreage of onions was reduced by 400 acres and that of carrots by 1,200 acres.

Other Crops.—There were increases in the acreages of fodder cabbage, kohl-rabi and rape, the total area under these crops being 134,300 acres, or 9,600 acres larger than in 1929. Vetches, lucerne and mustard for seed were also grown on increased acreages, the additions being 6,700 acres, 4,000 acres and 2,900 acres, respectively. The hop acreage shows a reduction of 4,000 acres or nearly 17 per cent., the area returned being 20,000 acres.

Fruit.—While the total acreage of orchard and small fruit remains little changed in extent as compared with last year, there was a loss in the orchard acreage of 1,400 acres which was almost counterbalanced by an increase of 1,300 acres in the area under small fruit. The principal variations in orchard acreages were increases of 901 acres in Kent and 648 acres in Hereford, while decreases were recorded of 590 acres, 572 acres and 563 acres in Devon, Somerset and Gloucester, respectively. Most counties contributed to the increase in the acreage of small fruit, the largest additions being 334 acres in Lincs (Holland), 185 acres in Essex and 161 acres in Kent.

Clover and Rotation Grasses and Meadow Hay.—The total acreage returned as under clover and rotation grasses was 2,424,000 acres, which is 55,000 acres more than in 1929. The proportion of this acreage returned as intended for hay is 1,594,000 acres, an area larger by 70,000 acres than that contributing to the hay harvest of 1929. The acreage of meadow hay was returned as 5,051,000 acres, or 355,000 acres more than in the previous year, and the total area, therefore, from which the hay crop of 1930 will be taken is 6,645,000 acres, showing an increase of 425,000 acres on that of 1929.

Bare Fallow.—The favourable conditions which existed for cultivation in 1928 were again prevalent in 1929, and the large decrease in the area left for bare fallow in the previous year was followed by a further reduction of some 30,600 acres. The total acreage returned this year was 294,800 acres, the smallest area recorded since 1912.

LIVE STOCK

The numbers of live stock on agricultural holdings on June 4, 1930, again showed reductions as compared with the previous year, with the exception of sheep, which showed an increase of 1·4 per cent. The reductions in the case of cattle and pigs were 1·9 per cent. and 2·6 per cent. respectively, against 1 per cent. and 20 per cent. in 1929,

while the decrease in the number of horses, at 3·8 per cent., was the same as that shown last year.

CATTLE.

	1930	1929	Increase		Decrease	
	No.	No.	No.	Per cent.	No.	Per cent.
Cows and Heifers in milk ..	2,028,600	2,054,100	—	—	25,500	1·2
Cows in Calf, but not in milk ..	289,000	293,700	—	—	4,700	1·6
Heifers in Calf ..	352,500	364,800	—	—	12,300	3·4
Other Cattle :—						
Two years and above ..	972,900	999,200	—	—	26,300	2·6
One year and under two ..	1,116,700	1,143,600	—	—	26,900	2·4
Under one year	1,086,300	1,102,200	—	—	15,900	1·4
TOTAL OF CATTLE	5,846,000	5,957,600	—	—	111,600	1·9

The total decrease in the number of cattle was 111,600. As was the case last year, the falling off was relatively least in the dairy herd as a whole, the reduction of 25,500 in the number of cows and heifers in milk representing a loss of 1·2 per cent. and that of 4,700 in the case of cows in calf, but not in milk, a loss of 1·6 per cent. Heifers in calf, on the other hand, showed a reduction of 12,300, or 3·4 per cent., the decrease in this class being relatively the heaviest among the various classes of cattle.

The reduction in the numbers of other cattle varied from 1·4 per cent. in the case of those under one year, which were fewer by 15,900 than in 1929, to 2·6 per cent. in the case of those two years old and above which were reduced by 26,300. The reduction in the number of other cattle between one and two years old was 26,900 or 2·4 per cent. The number of dairy cattle in Wales showed an increase, but throughout England there were fewer in the great majority of the counties, small increases being returned by a few counties, notably Devon, Norfolk, and in most of the northern counties. As regards other cattle, decreases were shown by the majority of counties, except in the South-Western division, in the number of cattle under one year old, and two years and over, while in the case of cattle between one and two years old the South-Eastern division and the West Midland and South-Western divisions returned increased numbers.

SHEEP

	1930	1929	Increase		Decrease	
	No.	No.	No.	Per cent.	No.	Per cent.
Ewes kept for Breeding ..	6,806,000	6,717,300	88,700	1·3	—	—
Other Sheep :—						
One year and above ..	2,453,300	2,454,000	—	—	700	·03
Under one year	7,069,300	6,934,200	135,100	1·9	—	—
TOTAL OF SHEEP	16,328,600	16,105,500	223,100	1·4	—	—

The reductions of 673,000 and 294,000 in the number of sheep which occurred in 1928 and 1929 were followed in 1930 by an increase of 223,100. The number of breeding ewes showed an increase of 88,700, or 1·3 per cent., in contrast to a reduction of 129,700 in 1929. The number of other sheep was practically unchanged in regard to those one year old and above, but in the case of sheep under one year there was an increase of 135,100, or 1·9 per cent. The increase in the number of breeding ewes was mainly confined to the Northern and Western divisions of the country and to Wales, where most of the counties returned larger numbers, but in the North-Eastern, Eastern, East Midland and South-Eastern divisions the number of breeding ewes showed a decrease. The increase in the number of sheep under one year old was distributed over much the same areas as in the case of breeding ewes, but in the case of sheep one year old and above the North-Western division and North Wales shared in the decrease shown in this class of sheep.

PIGS

	1930	1929	Increase		Decrease	
	No.	No.	No.	Per cent.	No.	Per cent.
Sows kept for Breeding ..	315,000	307,100	7,900	2·6	—	—
Other pigs ..	1,990,700	2,059,400	—	—	68,700	3·3
TOTAL OF PIGS..	2,305,700	2,366,500	—	—	60,800	2·6

The total number of pigs returned on June 4 again showed a reduction from that of the previous year, but the decrease which was 60,800, or 2·6 per cent., was small compared with the reduction of 604,500, or 20 per cent., shown in 1929. There was an increase in the number of breeding sows, which were 7,900, or 2·6 per cent. more than in the previous year, while the number of other pigs showed a decrease of 68,700, or 3·3 per cent. There were increases in both classes of pigs in the Northern and North-Western divisions and in Wales, and while net increases were shown in the number of breeding sows in the North-Eastern, West Midland and South-Western divisions the remainder of the country returned fewer.

HORSES

	1930	1929	Increase		Decrease	
	No.	No.	No.	Per cent.	No.	Per cent.
Horses used for Agricultural purposes (including Mares for Breeding) ..	682,600	706,800	—	—	24,200	3·4
Unbroken Horses (including Stallions) :—						
One year and above ..	89,300	92,100	—	—	2,800	3·0
Under one year ..	37,900	37,600	300	0·8	—	—
Other Horses ..	151,300	162,800	—	—	11,500	7·1
TOTAL OF HORSES	961,100	999,300	—	—	38,200	3·8

The total number of horses on agricultural holdings continues to decline, the reduction of 38,200 (or 3·8 per cent.) shown this year being relatively equivalent to that recorded in 1929. The number of horses used for agricultural purposes (including mares for breeding) declined by 24,200, a figure which does not differ substantially from the reduction in this class shown last year, and while there was a reduction of 2,800 in the number of unbroken horses one year and above, the number of foals is very little different from that returned last year. The decline in the number of foals which has slackened in the last few years has apparently been checked.

AGRICULTURAL WORKERS

	1930	1929	Increase		Decrease	
	No.	No.	No.	Per cent.	No.	Per cent.
Regular Male Workers :-						
21 years old and over	445,500	451,700	—	—	6,200	1·4
Under 21 years old	118,800	125,300	—	—	6,500	5·2
TOTAL ..	564,300	577,000	—	—	12,700	2·2
Casual Male Workers :-						
21 years old and over	69,800	79,600	—	—	9,800	12·3
Under 21 years old	10,700	11,300	—	—	600	5·3
TOTAL ..	80,500	90,900	—	—	10,400	11·4
TOTAL MALE WORKERS, REGULAR & CASUAL	644,800	667,900	—	—	23,100	3·5
Women and Girls:						
Regular Workers	65,400	67,000	—	—	1,600	2·4
Casual Workers	31,600	35,400	—	—	3,800	10·7
TOTAL ..	97,000	102,400	—	—	5,400	5·3
TOTAL WORKERS ALL CLASSES ..	741,800	770,300	—	—	28,500	3·7

The total number of agricultural workers showed a reduction of 28,500, or nearly 4 per cent., to which all classes contributed. Proportionately the smallest decrease was in regular male adult workers, which amounted to 6,200, or about 1½ per cent. The number of casual male adult workers on the other hand declined by 9,800, or over 12 per cent., and of casual female workers by 3,800, or nearly 11 per cent.

HOPS

Acreage of Hops.—Preliminary statement compiled from the returns collected on June 4, 1930, showing the acreage under Hops in each County of England in which Hops were grown, with a comparative statement for the years 1929 and 1928.

Counties, &c.					1930	1929	1928
					Acres	Acres	Acres
Kent ..	{	East .. ..	..	..	2,650	3,310	3,280
		Mid .. ..	..	..	3,610	4,900	4,940
		Wesd .. ..	..	..	5,510	6,660	6,580
	Total, Kent ..				11,770	14,870	14,800
Hants .. ..	..	..	..	..	870	1,010	990
Hereford ..	..	..	..	..	3,690	3,860	3,780
Surrey .. ..	..	..	..	..	140	160	160
Sussex .. ..	..	..	..	..	1,700	2,140	2,150
Worcester ..	..	..	..	..	1,730	1,810	1,790
Other Counties	..	..	..	..	70	130	130
TOTAL					19,970	23,980	23,800

SEPTEMBER ON THE FARM

WILLIAM LAWSON, M.B.E., N.D.A., N.D.D.,

Director of Agriculture for West Sussex.

Rotation of Crops.—In the normal four-course rotation, the land after a wheat crop is subjected to cleaning and tilling operations to destroy weeds and to improve the physical condition of the soil. In most cases, a root or other cleaning crop is taken in what may be described as the cleaning year of the rotation; this may be potatoes, which are grown for their cash value as well as the opportunity they afford for cleaning the land; in other cases sugar beet is cultivated for a like purpose, and has an advantage over potatoes in that the tops are of considerable value as stock food and, when fed off on the land, improve its manurial condition. Where mangolds are grown the roots are usually carted off, but the tops remain and are of considerable manurial value, especially when evenly spread and ploughed under in a fairly fresh condition. The grower of potatoes, sugar beet or mangolds manures the land with farmyard manure and a complete dressing of mineral manures to ensure the most profitable return from these crops; in each case there is a manurial residue which should benefit succeeding crops. The two-fold object of the cleaning year is thus obtained.

An area approximately equal to that devoted to potatoes, sugar beet and mangolds is sown with turnips, swedes, cabbage, kale or rape. The great bulk of this produce is fed off on the land by sheep. In many cases the swedes, turnips and rape are grown without farmyard manure, but with such mineral

manures as circumstances demand. The supply of farmyard manure may not extend to the whole area under roots, and the fields may be so far removed from yards and buildings where the manure is made as to make it impracticable for the manure to be carted to them. In these cases the aim is to provide a cleaning crop, a food for stock and a means of improving the manurial condition of the land by the residues from the sheep. On the lighter and poorer soils great stress is laid on the last-named benefit, and a failure of the root crop is not regarded so seriously from the point of view of the shortage of stock food as the insufficient manurial dressing which is a consequence and which affects the cropping capacity of the land for a whole rotation.

In favourable circumstances some of the area cleared of roots can be sown with autumn-sown wheat, and this is often advantageous in that it ensures a better crop of grain than might be obtained from a spring-sown crop. On the other hand an autumn-sown grain crop is less suited as a "nurse" for seeds of clovers and grasses. The major portion of the root area is devoted to spring-sown grain crops in the following year, and in this crop the seeds for the clover and hay crop are sown.

The spring-sown grain crop is a weak link in the rotation. The growth of barley of good malting quality may provide remunerative returns, and there are conditions under which this may be the pivotal crop, yet the greater area is devoted to oats or barley of feeding quality only, and such crops seldom yield sufficiently well to pay for the direct cost of their cultivation as well as the beneficial cultivations and manurial residues from the previous cropping; consequently succeeding crops must compensate for this deficiency.

The hay crop in the rotation is varied in character; in some cases red clover only is sown, or, alternately in the rotation, a mixture of trefoil and white clover is taken to avoid the too frequent use of red clover and the occurrence of clover sickness. One-year leys may also consist of a mixture of rye-grasses and clovers, and where the ley is to remain for more than one year a varied mixture of grasses and clovers is used. The hay crop is grown at a minimum of expenditure. The total return per acre may be of small value, but it is not unusual for the net returns to compare favourably with the other crops in the rotation, and the hay crop may be regarded as at least self-supporting. Its influence on the succeeding crop will depend on the extent to which clover,

and in particular red clover, was a constituent. A pure red clover ley is an excellent preparation for a wheat crop. The presence of rye-grass is regarded as injurious to the wheat crop, and many farmers refuse to use rye-grass in their mixture or prefer to follow a rye-grass mixture with oats rather than wheat. The reason would appear to be that the soil is insufficiently supplied with nitrogen where rye-grass has predominated, and what is present is used by soil organisms in breaking down the organic matter and not available for the early growth of the grain crop. Oats are affected as well as wheat, but the consequences seem less. There is need for experiment as to the amount and kind of manure which would counteract the effects produced by rye-grass mixtures.

In a four-course rotation, using pure clover as a hay crop, practically the whole of the benefits due to the accumulation of organic matter are concentrated on the grain crop immediately following. Each crop in the rotation so far has contributed benefits to its successor, but this cannot be claimed for the grain crop which follows the clover. It is the climax and when it is harvested the whole procedure of preparing for another rotation has to begin over again. Rotations may be lengthened or modified in various ways, but it is necessary to take into consideration the benefits an individual crop confers on its successors or its ability to utilize economically the benefits conferred by preceding crops. Wheat as usually grown does not confer benefits, but responds to benefits handed down.

Wheat.—In spite of the low price obtained for wheat in recent times this crop is an important one to the arable farmer. A considerable area of the arable land in eastern and southern England is kept under the plough by the use of wheat as a pivotal crop.

In preparing for wheat it is necessary to remember that wheat likes solid ground; early ploughing and allowing the land to consolidate may partly account for the preference farmers have for a "stale" furrow. Where ploughing is deferred the use of a furrow presser is a common feature in the Southern Counties, and Kent is noted for the practice of cartwheeling, which fulfils the same purpose as the furrow presser. Furrow pressing is most important on the lighter soils, both chalks and sands. The writer has seen a field on a light loamy soil where the only wheat that survived the winter was in the tracks of the wheels of a cart which crossed the field loaded with seed wheat at sowing time. When land

is furrow pressed the seed can be broadcast and is easily covered without harrowing the land down to a fine condition. On heavy soils pressing may do harm if the work is done when the soil is wet, and lack of surface drainage may severely injure the wheat during a wet period.

The method of ploughing the land varies with the type of soil. Adequate surface drainage must be allowed for; on the stiffest of clays the land is ploughed in narrow "lands" or "stetches," sometimes as narrow as eight feet or sufficient to enable a drill to take a width between the open furrows. On easier working land, the width between the open furrows is made wider. With the more general use of tractors, the tendency has been to widen the space between the open furrows, with the result that in many cases the wheat has suffered. Water furrowing is often necessary even on light land. The skilful drawing of a few furrows across the slope of a field to convey surface water easily and quickly off the field makes a very material difference to the average yield. These furrows not only take away surface water but they prevent the excessive washing down of material on sloping fields.

There is a wide range of time during which wheat can be sown, from late September until Christmas and again in February, March, and even April. On the poorest and wettest of clay soils, and on land which is bare fallowed, late September sowing is desirable; the only real drawback to early sowing on such soils is that these types are often infested with slender foxtail grass, commonly called black grass. This is a difficult weed to contend with, and whilst later sowing would allow of the destruction of the surface weeds which have germinated, such a delay would often be fatal to the seeding of the wheat. On most soils October and November are suitable months, and the middle of October is highly favoured.

A farm foreman after 42 years' experience on a medium loam in Sussex told the writer that all the outstanding crops he could remember were drilled between October 15 and 20.

The quantity of seed will vary with the nature of the land and the time of sowing. Early sowing and a good tilth require less seed; the range may be between 2 and 4 bushels. Instances have been noticed where by accident as small a quantity as one bushel has been sown, and where this was sown early the crop proved excellent. If it were possible to ensure the equal distribution of a small seeding and the growth of every seed, a single bushel of seed would be more than enough,

but with the drills at present in use and the heavy losses which take place between the sowing of the seed and the vigorous growth in April, it would not be safe to advise, generally, such small seedings.

* * * * *

NOTES ON FEEDING STUFFS

H. G. SANDERS, M.A., Ph.D.,
School of Agriculture, Cambridge.

Home-Grown Foods.—When the prices of their produce are low, farmers have to consider very carefully the question whether it will pay better to feed it to stock instead of selling it and buying in other feeding stuffs. Feeding of home-grown foods eliminates the expense of delivery and saves carting cake, so that the policy of making all the produce walk off the farm has much to recommend it. It is simply a question of price plus a realization of the limitations of the various foods. As to the former, figures based on the latest quotations are provided below these notes each month. In what follows, roots, silage, grass, etc., are omitted, since their general nature justifies the usual policy of consuming them on the farm that grows them. The difficulty of decision arises chiefly in the case of cereals and pulses, and, more rarely, with potatoes.

It must always be realized that a low price is not enough to make any food desirable: however low the price, money will still be wasted if animals are fed on unsuitable feeding stuffs. This aspect must be kept carefully in mind, for with low cereal prices farmers are apt to feed them unwisely, forgetting their low protein content. A generous provision of carbohydrate without an adequate allowance of protein is unsound policy, so that with classes of stock that require much of the latter—cows and growing animals—there is a relatively low limit to the amount of cereals that can be used. Fortunately, beans and peas are much richer in protein than cereals, and their addition to the mixture will help to balance it up; nevertheless, their protein is not sufficiently high to warrant admixture with really large quantities of cereals. In many cases, therefore, it is more economical to purchase a certain amount of a really rich food, such as decorticated cotton seed meal or decorticated ground nut cake; 1 lb. of either of these will balance up 3 lb. of cereals, whereas beans can only balance their own weight.

For fattening cattle a large part of the ration may be home-grown if, but only if, a good allowance of hay is provided.

With straw and roots there will be a shortage of protein, and only by the use of bought, protein-rich concentrates can a ration containing much cereal be satisfactorily adjusted. As fattening proceeds, however, the extra food needed will be starchy material, and this is where cereals can be usefully employed.

A fair proportion of cereals can also be included in rations for dairy cows, except for the highest yielders. Oats are good, but have not a high enough starch equivalent for the best

PRICES OF ARTIFICIAL MANURES

Description	Average prices per ton during week ended August 6				
	Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) ..	9 7d	9 7d	9 7d	9 7d	12 1
Nitro-chalk (N. 15½%) ..	9 19d	9 19d	9 19d	9 19d	12 10
Sulphate of ammonia:—					
Neutral (N. 20·6%) ..	10 2d	10 2d	10 2d	10 2d	9 10
Calcium cyanamide (N. 20·6%)	9 6e	9 6e	9 6e	9 6e	9 0
Kainit (Pot. 14%) ..	3 6	2 19	2 19	2 18	4 2
Potash salts (Pot. 30%) ..	5 3	4 18	5 0	4 11	3 0
" (Pot. 20%) ..	3 15	3 9	3 8	3 6	3 4
Muriate of potash (Pot. 50%)	9 17	9 3	9 2	8 12	3 5
Sulphate,, (Pot. 48%)	11 19	11 6	11 5	10 7	4 4
Basic Slag (P.A. 15½%)||	2 13c	2 3c	..	2 9c	3 1
" (P.A. 14%)||	2 7c	1 16c	1 16c	2 3c	3 2
" (P.A. 11%)||	..	1 9c	1 9c	..	..
Ground rock phosphate (P.A. 26·27½%)||	2 2a	2 10a	2 5a	2 7a	1 9
Superphosphate (S.P.A. 16%)	3 11	..	3 9	3 6	4 2
" (S.P.A. 13½%)	3 5	2 18	3 3	3 0	4 4
Bone meal (N. 3¼%, P.A. 20½%)	8 15	8 10	8 7	6 15	..
Steamed bone flour (N. ¼%, P.A. 27½-29½%)	5 17b	5 15f	6 10	4 7	..

Abbreviations: N.—Nitrogen; P.A.—Phosphoric Acid; S.P.A.—Soluble Phosphoric Acid; Pot.—Potash.

* Prices are for not less than 6-ton lots, for delivery during the month, at purchaser's nearest railway station, unless otherwise stated. Unit values are calculated on carriage paid price.

† Prices are for not less than 2-ton lots, net cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. price.

|| Fineness 80% through standard sieve. a Prices for 6-ton lots f.o.r. at makers' works.

b Delivered (within a limited area) at purchaser's nearest railway station.

c Prices for 6-ton lots; at Bristol, f.o.r. Bridgwater; at Hull and Liverpool, f.o.r. neighbouring works, and at London f.o.r. depots in London district.

d For lots of 4 tons and under 6 tons the price is 1s. per ton extra and for lots of 2 tons and under 4 tons 5s. per ton extra.

e Delivered in 4-ton lot at purchaser's nearest railway station.

f Delivered Yorkshire stations.

milkers, and consequently tend to make the mixture too bulky. Wheat and barley give heavy meals and tend to become pasty in the stomach, and consequently should be used very moderately. There is a belief among practical men that barley tends to dry the milk up, but this has never been definitely proved. In general, if it is required to include the greatest possible amount of cereals in the ration it will be found better to add a little of the dearer, rather than much of the cheaper, purchased concentrates.

For pigs it is common to use large quantities of barley meal and millers' offals, and crushed wheat can be substituted for the latter if the price is low. A large proportion of the ration can be in the form of cereals, and the protein balance can be maintained by the addition of quite small quantities of fish meal, etc. Separated milk and whey are excellent for pigs, and it is well known that one of the mainstays of the Danish system of agriculture is the production of bacon from skimmed milk and cereals. With pigs, again, a lower proportion of protein can be included later on in the fattening period. In Denmark the ration used in pig testing stations for pigs 8 weeks old contains about 30 per cent. of its nutrients in the form of skimmed milk and 70 per cent. as cereals, but as the pigs get older more cereals and less skimmed milk are used, and by the time of slaughter the percentages are 15 and 85 respectively.

A few years ago a comprehensive experiment was carried out at the Harper Adams Agricultural College by Crowther and Chalmers to ascertain what were the best home-grown foods for pigs. In all, 12 lots of 10 pigs each were included: they were between 10 and 16 weeks old at the beginning of the trial, and the experimental feeding was continued for 20 weeks. The most striking result was the very beneficial effect of separated milk and whey; the pigs receiving these averaged about $1\frac{1}{2}$ lb. a day live weight increase over the whole period, as compared to about $\frac{3}{4}$ lb. to 1 lb. for the other pens. If separated milk was included, a simple mixture of wheat and barley was satisfactory, and nothing was gained by adding oat, bean or pea meal to it. The experiment agreed with Danish practice in showing the great value of a ration consisting of cereals and separated milk. After the rations containing separated milk and whey (and there seemed little to choose between these two) the most effective were mixtures containing cereals and beans or peas. This would be expected as the addition of pulses would help to balance up the cereals.

Three of the pens were fed on cereals alone, and it was concluded that satisfactory rations could not be made up from them: the rations were all low in protein, containing less than 0.4 lb. per pig per day. As regards the particular cereals, oats were found to be definitely bad. Considerable difficulty was experienced in getting the pigs to clear them up, this difficulty being only overcome by thorough grinding of the oats. The live weight gain was disappointing. In view of the fact that the pig has no special means of dealing with fibre it is only to be expected that a husky grain like the oat would be bad, and its use for pigs can hardly ever be worth while.

As regards the feeding of potatoes, some farmers have found during the last year or two that home consumption is the only way of getting rid of them. Their analysis shows 75 per cent. of water and 21 per cent. of carbohydrates; in addition they contain a small proportion of protein-like substances, but these are mostly ammonia compounds of little nutritive value. Potatoes contain acrid substances which act as irritants in the body and may, if they are being fed in large quantities, cause scouring. They also increase the flow of saliva abnormally, and it can often be seen dripping in stringy threads from the mouth. A small proportion of a definite poison—solanine—is present, but the only real danger from this is when the potatoes are sprouting: the solanine is concentrated in the young sprouts (also, to a certain extent, when greening of tubers occurs), making them dangerous to eat. In view of the objectionable substances mentioned above it is better to cook, or at least to steep, potatoes before feeding: cooking is the best as it makes the starch more easily digestible (potato starch is in the form of characteristically large grains). In the stomach, potatoes ferment readily and tend to produce much gas.

Potatoes should be introduced very gradually into the ration, and should never be fed above a certain amount. Cattle have been fed successfully with as much as 50 lb. a day, and can deal with them in their raw state rather better than other stock. Milking cows should not receive so much, and 25 lb. should be regarded as the limit, especially as they tend to produce butter of poor flavour. In substituting potatoes for mangolds it must be remembered that their starch equivalent is more than twice as high as that of mangolds. Sheep may be given 2 or 3 lb. a day, but no more. For horses it is generally recommended that 5 lb. a day should be about the maximum,

DESCRIPTION	Price per qr.		Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.	Price per lb. starch equiv.	Pro- tein equiv.
	s. d.	lb.	£ s.	£ s.	£ s.		s. d.	d.	%
Wheat, British	—	—	8 5	0 11	7 14	72	2 2	1.16	9.6
Barley, British feeding	—	—	6 10	0 9	6 1	71	1 8	0.89	6.2
" Danubian	18 0	400	5 0*	0 9	4 11	71	1 3	0.67	6.2
" Persian	17 9	..	5 0	0 9	4 11	71	1 3	0.67	6.2
" Russian	18 9	..	5 5	0 9	4 16	71	1 5	0.76	6.2
Oats, English, white	—	—	6 5	0 10	5 15	60	1 11	1.03	7.6
" black and grey	—	—	5 15†	0 10	5 5	60	1 9	0.94	7.6
" Argentine	15 9	320	5 10	0 10	5 0	60	1 8	0.89	7.6
" Chilian	16 0	..	5 12	0 10	5 2	60	1 8	0.89	7.6
" German	20 6	..	7 3	0 10	6 13	60	2 3	1.20	7.6
Maize, Argentine	32 3	480	7 10	0 9	7 1	81	1 9	0.94	6.8
" South African	30 6	..	7 2	0 9	6 13	81	1 8	0.89	6.8
Peas, Japanese	—	—	15 15§	1 0	14 15	69	4 3	2.28	18
Dari	—	—	8 0	0 11	7 9	74	2 0	1.07	7.2
Milling offals—									
Bran, British	—	—	4 10	1 0	3 10	42	1 8	0.89	10
" broad	—	—	4 15	1 0	3 15	42	1 9	0.94	10
Middlings, fine, imported	—	—	5 15	0 16	4 19	69	1 5	0.76	12
" coarse, British	—	—	5 10	0 16	4 14	58	1 7	0.85	11
Pollards, imported	—	—	4 17	1 0	3 17	60	1 3	0.67	11
Meal, barley	—	—	7 0	0 9	6 11	71	1 10	0.98	6.2
" maize	—	—	7 15	0 9	7 6	81	1 10	0.98	6.8
" " South African	—	—	6 5	0 9	5 16	81	1 5	0.76	6.8
" " germ	—	—	6 10	0 14	5 16	85	1 4	0.71	10
" locust bean	—	—	7 10	0 7	7 3	71	2 0	1.07	3.6
" bean	—	—	10 15	1 4	9 11	66	2 11	1.56	20
" fish	—	—	18 0	3 1	14 19	53	5 8	3.04	48
Maize, cooked flaked	—	—	8 17	0 9	8 8	83	2 0	1.07	8.6
" gluten feed	—	—	6 15	0 19	5 16	76	1 6	0.80	19
Linseed cake, English, 12% oil	—	—	10 5	1 8	8 17	74	2 5	1.29	25
" " " 9% "	—	—	9 10	1 8	8 2	74	2 2	1.16	25
" " " 8% "	—	—	9 5	1 8	7 17	74	2 1	1.12	25
Soya bean cake, 5½% oil	—	—	8 12*	1 19	6 13	69	1 11	1.03	36
Cottonseed cake—									
" " English, 4½% oil	—	—	4 15	1 6	3 9	42	1 8	0.89	17
" " Egyptian, 4½% "	—	—	4 7	1 6	3 1	42	1 5	0.76	17
Ground-nut cake, 6.7% oil	—	—	6 10†	1 6	5 4	57	1 10	0.98	27
Decorticated ground-nut cake, 6.7% oil	—	—	7 15†	2 0	5 15	73	1 7	0.85	41
Palm kernel cake, 4½-5½% "	—	—	5 5†	0 17	4 8	75	1 2	0.62	17
" " " meal, 4½% "	—	—	5 15†	0 17	4 18	75	1 4	0.71	17
" " " meal 1.2% oil	—	—	5 0†	0 17	4 3	71	1 2	0.62	17
Feeding treacle	—	—	6 7	0 8	5 19	51	2 4	1.25	2.7
Brewers' grains, dried ale	—	—	4 15	0 17	3 18	48	1 7	0.85	13
" " " porter	—	—	4 5	0 17	3 8	48	1 5	0.76	13
Malt culms	—	—	6 0§	1 5	4 15	43	2 3	1.20	16

* At Bristol. † At Hull. § At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of July and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative values of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, if palm kernel cake is offered locally at £7 per ton, then since its manurial value is 17s. per ton as shown above, the food value per ton is £3 8s. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 1s. 8d. Dividing this again by 22.4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 0.89d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculation a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own markets. The figures given in the table under the heading manurial value per ton are calculated on the basis of the following unit prices:—N., 9s. 0d.; P₂O₅, 2s. 10d.; K₂O, 8s. 0d.

but in one American inquiry no harm resulted from giving horses as much as 17½ lb.

Pigs seem to provide the best outlet if potatoes must be used on the farm, and during the past year they have figured widely in pig rations. For young pigs they are not suitable because of the possible risk of their rather "unsafe" components, and also because they are too starchy for growing

Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follow :—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (imported)	71	6.2	5 2
Maize	81	6.8	7 6
Decorticated ground nut cake	73	41.0	7 15
" cotton cake	71	34.0	8 10

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 1.64 shillings, and per unit protein equivalent, 1.45 shillings. An explanation of the method of calculation employed is given in the Report of the Departmental Committee on Rationing of Dairy Cows.*

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The "food values" which it is recommended should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows are given in the November, 1929, issue of the Ministry's JOURNAL.)

FARM VALUES.

CROPS	Starch equivalent Per cent.	Protein equivalent Per cent.	Food value per ton, on farm £ s.
Wheat	72	9.6	6 12
Oats	60	7.6	5 9
Barley	71	6.2	6 5
Potatoes	18	0.6	1 10
Swedes	7	0.7	0 12
Mangolds	7	0.4	0 12
Beans	66	20.0	6 17
Good meadow hay	37	4.6	3 7
Good oat straw	20	0.9	1 14
Good clover hay	38	7.0	3 12
Vetch and oat silage	13	1.6	1 4
Barley straw	23	0.7	1 19
Wheat straw	13	0.1	1 1
Bean straw	23	1.7	2 0

* Obtainable from H.M. Stationery Office, Adastral House, Kingsway, W.C.2, price 6d. net.

animals, as they contain practically no flesh-forming nutrients. In general potatoes should not be used for pigs younger than about 4 months. If cooked before use, and if they are introduced gradually into the ration, as much as 12 to 15 lb. a day may be permitted for older pigs. Several trials have been made both in America and on the Continent to compare them with meals. In one it was found that 440 lb. of maize meal were equivalent to 262 lb. of maize meal plus 786 lb. of potatoes, both producing 100 lb. increase in live weight. Thus, 786 lb. of potatoes gave the same return as 178 lb. of maize meal, this being in conformity with the general experience that something like 4 lb. of potatoes are equivalent to 1 lb. of the common meals.

MISCELLANEOUS NOTES

THERE are at present 17 farm institutes in England and Wales. The primary object of these institutes is to provide instruction in the scientific principles

**Courses at
County Farm
Institutes**

underlying sound farming practice, and they have been specially and extensively equipped for the purpose. The instruction given is closely related to practice; this applies not only to general agriculture, but also to market gardening, fruit-growing, dairying and poultry-keeping. The subjects dealt with and their order of importance vary somewhat at the different institutes, but a typical curriculum includes the following: soils, manures, crops, live stock, feeding stuffs, implements and machinery, veterinary hygiene, surveying and mensuration, farm book-keeping, general agricultural science (biology and chemistry), horticulture, dairying, poultry-keeping, bee-keeping, and fungus and insect pests. Most of the courses start in October, one term being taken before Christmas and one after, but in some cases a full year's course is provided. Facilities are also provided for short courses in special subjects, and most of the institutes provide instruction for women—particularly in such subjects as dairying, horticulture and poultry-keeping.

The institutes are situated in the following counties: Cheshire (at Reaseheath, near Nantwich); Cumberland and Westmorland (at Newton Rigg, near Penrith); Essex (at Chelmsford); Hampshire (at Sparsholt, near Winchester); Hertfordshire (at Oaklands, St. Albans); Kent (at Borden, near Sittingbourne); Lancashire (at Hutton, near Preston);

Lincolnshire, Holland (at Kirton, near Boston); Northamptonshire (at Moulton, Northampton); Somerset (at Cannington, near Bridgwater); Staffordshire (at Rodbaston, Penkridge); West Suffolk, the Chadacre Agricultural Institute (at Hartest, Bury St. Edmunds); East Sussex (at Plumpton); Caernarvonshire (at Madryn Castle, Bodfean); Carmarthenshire (at Pibwrlwyd, Carmarthen); Denbighshire (at Llysfasi, Ruthin); and Monmouthshire (at Usk, Newport).

A certain number of scholarships tenable at the institutes are awarded by the various County Councils to residents within their areas, and the Ministry itself awards scholarships thereat for the sons and daughters of agricultural workers.

Brief particulars of the courses for the session 1930-31 are contained in a leaflet (Form No. 732/T.E.), which can be obtained from the Ministry; more detailed information will be furnished by the Principal of the Institute concerned. Anyone desirous of attending one of the courses commencing in October should make immediate application to the Principal.

* * * * *

THE general index number of the prices of agricultural produce in July was 3 points higher on the month at 34 per cent. above the base years 1911-13 as compared with 41 per cent. a year ago. Wheat, barley, oats and hay showed a further fall in price during July, but the effect of this fall was more than counterbalanced by the increased values for milk, eggs and potatoes.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1925 :—

Month	Percentage increase compared with the average of the corresponding month in 1911-13.							
	1925	1926	1927	1928	1929	1930		
January	71	58	49	45	45	48		
February	69	53	45	43	44	44		
March	66	49	43	45	43	39		
April	59	52	43	51	46	37		
May	57	50	42	54	44	34		
June	53	48	41	53	40	31		
July	49	48	42	45	41	34		
August	54	49	42	44	52	—		
September	55	55	43	44	52	—		
October	53	48	40	39	42	—		
November	54	48	37	41	44	—		
December	54	46	38	40	43	—		

Grain.—The average prices of wheat, barley and oats were lower on the month by 3d., 6d. and 2d. per cwt. respectively and in each case the index showed a fall. Wheat was 5 points lower at 2 per cent. above pre-war, while barley declined by 8 points and oats by 4 points to 12 per cent. and 20 per cent., respectively, below the level of the base years.

Live Stock.—A slight decline was recorded in the prices of fat cattle and fat pigs, but fat sheep were unaltered either in price or index number. In the case of fat cattle the fall of 1s. per live cwt. was less than that which occurred in the corresponding period in the base years and the index was consequently higher by 3 points at 30 per cent. above pre-war. Bacon pigs were 6 points lower at 40 per cent. and pork pigs 3 points lower at 49 per cent. above the level of 1911–13. Dairy cows were appreciably dearer, the average price rising by over £1 per head and the index by 3 points to 32 per cent. above the base years. Store cattle, sheep and pigs were cheaper, as is customary at this period of the year, but store cattle and sheep prices did not fall to the same extent as in July, 1911–13, and the indices rose by 1 and 13 points to 29 per cent. and 78 per cent., respectively, above pre-war. Store pigs fell one point to 100 per cent. above the level of the base years.

Dairy and Poultry Produce.—The indices for milk and butter rose on the month by 3 and 7 points, respectively, to 58 per cent. and 31 per cent. in excess of the pre-war level as compared with 57 per cent. and 52 per cent. a year ago, but a considerable fall in the price of cheese reduced the index number by 10 points to 32 per cent. above pre-war as compared with 67 per cent. a year earlier. Eggs were about 3½d. per dozen dearer than in June and the index rose by 15 points to 44 per cent. above the level of the base years, but poultry was rather cheaper, a fall of 10 points to 47 per cent. being recorded.

Other Commodities.—The prices realized in July for first early potatoes were 23 per cent. higher than in July, 1911–13, as compared with a figure of 4 per cent. below pre-war recorded last year. Hay prices were reduced by from 4s. to 5s. per ton during July and the index was 7 points lower at 18 per cent. above pre-war, as against 29 per cent. in July, 1929. Fruit as a whole was considerably cheaper this July than last, the general index being 34 per cent. in excess of the base years as compared with 73 per cent. in the previous year. Vegetables, however, were slightly dearer both on the month and year. Wool prices declined a little further to 4 per cent. below the pre-war level.

Index numbers of different commodities during recent months and in July, 1928 and 1929, are shown below :—

Percentage Increase as compared with the Average
Prices ruling in the corresponding months of
1911-13.

Commodity	1928	1929	1930			
	July.	July.	Apl.	May.	June.	July.
Wheat	34	28	14	11	7	2
Barley	37	30	Nil	—1*	—4*	—12*
Oats	58	23	—11*	—11*	—16*	—20*
Fat cattle	44	30	33	30	27	30
Fat sheep	66	55	56	63	66	66
Bacon pigs	41	64	76	61	46	40
Pork pigs	34	61	80	67	52	49
Dairy cows	34	33	30	29	29	32
Store cattle	31	25	24	28	28	29
Store sheep	67	60	43	46	65	78
Store pigs	25	80	113	108	101	100
Eggs	36	57	40	28	29	44
Poultry	54	57	55	64	57	47
Milk	55	57	58	55	55	58
Butter	50	52	30	23	24	31
Cheese	81	67	41	52	42	32
Potatoes	37	—4*	—39*	—36*	—40*	23
Hay	11	29	30	28	25	18
Wool	78	45	3	Nil	—1*	—4*

* Decrease.

* * * * *

Post-Graduate Agricultural Scholarships.—On the recommendation of the Advisory Committee on Agricultural Science, post-graduate agricultural training scholarships have been awarded to the following :—

Name	Subject
E. L. Jones ..	Agricultural Economics
L. C. Couch ..	Animal and Crop Husbandry with special reference to animal husbandry
R. W. R. Miller ..	Crop Husbandry
Miss A. A. Nichols ..	Dairying (one year only)

Research Scholarships.—On the recommendation of the Advisory Committee on Agricultural Science, research scholarships have been awarded to the following :—

Name	Subject
G. M. Wickens ..	Plant Pathology
W. F. Jopson ..	Entomology
S. Gladstone-Solomon	Helminthology
J. S. Steward ..	Veterinary Science
R. Grant ...	Animal Genetics
M. H. French ..	Animal Nutrition
B. I. Felton ..	Agricultural Economics

The agricultural scholarships are usually tenable for two, and the research scholarships for three, years. The second year, or third year, as the case may be, is usually spent abroad. The value of each scholarship is £200 in the first year; extra travelling and subsistence expenses may be paid in the year which is spent abroad. Scholars' fees are also paid.

Travelling Research Fellowships and International Conference Grants, 1930.—On the recommendation of the Advisory Committee on Agricultural Science, the following awards have been made :—

<i>Name</i>	<i>Institute or College</i>	<i>Country and Period</i>	<i>Purpose</i>	<i>Amount</i>
Pease, M. S.	Small Animal Breeding Institute, Cambridge	Germany, August 23-27, 1930	International Conference on Rabbit Breeding, Leipzig	£30
Parkhurst, Prof. R. T.	National Institute of Poultry Husbandry, Newport, Salop	do.	do.	20
Glynne, Miss M. D.	Rothamsted Experimental Station, Harpenden, Herts	Germany, end September to end October, 1930	Study of wart disease problems and methods of infection and to confer with German workers	45

* * * * *

THE following note has been communicated by the National Institute of Agricultural Botany. The records collected by the National Institute of Agricultural

Varieties of Cereals for Autumn Sowing Botany from its trial stations, from County Agricultural Organizers, and from farmers themselves not only provide reliable and unbiassed knowledge about the merits of varieties, but prove that a wider application of this knowledge would substantially improve the yield and quality of crops over wide areas. The following notes do not necessarily apply to the North of England, but in other districts they may be accepted with some confidence. Those who wish to have fuller particulars than are given here can obtain them by writing to the Institute at Cambridge.

Winter Wheats

The mild, wet and windy winter, the heavy storms in the early summer, and the prolonged rains of July and August

not only separated the strong-strawed from the weak, but favoured the development of such diseases as foot-rot and whiteheads. The knowledge of the reaction of wheat varieties to these diseases is far from complete, but there is no reason to believe that any one variety is markedly more resistant or more susceptible to them than another. The season has also reminded growers that winter-hardiness means something more than mere resistance to frost; wind and rain can play their part in thinning the plant and it was noticeable that Scandinavian and Dutch varieties, bred in more rigorous climates, were, with few exceptions, less adapted than such a variety as Squarehead's Master to survive successfully the conditions which prevailed last winter.

The value of change of seed is another subject of perennial interest. It may help farmers to know that, given seed of equal purity and germination, there is no definite evidence that Scandinavian or Continental-grown stocks will give better results than stocks of the same variety grown in England. The introduction of Scandinavian varieties has incidentally led to some confusion in names; the usual practice has been to translate the original foreign name into its English equivalent, but in one instance entirely different English names have been used. Thus Millennium, Monarch and Red Chaff Squarehead wheats are Danish-grown stocks of Crown, Steel and Squarehead's Master respectively. The same thing applies in the case of a "January White Oat," which is Danish-grown Victory oats, and of a "Two-rowed Winter Malting Barley" which is Danish-grown Victory barley.

The Institute is no less anxious than seed-merchants and farmers to find improved varieties, but it sees no reason at present to vary the recommendations given in previous years. Wilhelmina or Victor are the most reliable high-yielding varieties on soils in good condition; Yeoman or Yeoman II possess unique bread-making quality and are the varieties to grow on the richest soils or under intensive manuring; Little Joss should be chosen for the lighter wheat soils, particularly in Norfolk, or where fertility is low; Iron III, though less reliable than Wilhelmina and apt to develop rust, finds a place, like Weibull's Standard, on heavy soils. Rivett, or Blue Cone, probably outyields all other varieties on heavy soils in the South of England, and Squarehead's Master stands by itself in its adaptability to all sorts of conditions and the regularity with which it gives a respectable crop.

Most of the other varieties which are likely to be on the market this autumn have either not yet been sufficiently tested to be recommended or they lack any distinguishing superiority over the older or better known kinds.

Winter Oats

The farmer who wants to be sure of his crop year in year out can choose only one variety, Grey Winter. It has one serious defect, weak straw. Such slight advantage as Black Winter may have on this score is offset by a degree or two of inferiority in resistance to frost and quality of grain. There is no winter-hardy white oat on the market. If strength of straw is essential the least risky variety to choose is the black-grained Bountiful.

Winter Barley

The ordinary six-row winter barley almost always gives a satisfactory crop, but the grain is not of malting quality. None of the two-row malting types is winter-hardy, but Plumage-Archer and Spratt-Archer can be sown without much risk if exposed situations and ill-drained soils are avoided. They generally succeed and when they do the yield and quality are substantially better than in the case of spring-sown crops.

The Hannah Dairy Research Institute.—The offices of the Hannah Dairy Research Institute have now been transferred from Glasgow to the Institute's permanent headquarters at Auchincruive, Ayr.

Enforcement of Minimum Rates of Wages.—During the month ending August 14 legal proceedings were instituted against seven employers for failure to pay the minimum rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases are as follows:—

County	Court	Fines			Costs			Arrears of wages			No. of workers involved	
		£	s.	d.	£	s.	d.	£	s.	d.		
Somerset	Langport	..	—			1	3	0	17	0	0	1
Somerset	Langport	..	Case dismissed									1
Wiltshire	Wootton Bassett	..	2	0	0	—			15	6	8	1
Yorks W.R.	Knaresborough	..	0	5	0	0	2	6	6	3	11	1
Glamorgan	Swansea	..	4	0	0	—			11	2	6	1
Radnor	Clyro	..	0	10	0	0	6	6	17	0	0	1
Radnor	Clyro	..	1	0	0	0	10	6	1	18	6	1
			£7	15	0	£2	2	6	£68	11	7	7

APPOINTMENTS

COUNTY AGRICULTURAL EDUCATION STAFFS : ENGLAND

Lancashire : Miss W. W. Young has been appointed Assistant Instructress in Poultry Keeping, *vice* Miss M. L. Sinclair.

Lincolnshire (Lindsey) : Mr. A. McVicar, B.Sc., N.D.A., N.D.D., has been appointed Agricultural Organizer, *vice* Mr. J. A. McMillan, B.Sc.

Norfolk : Mr. J. C. Mann, M.A., has been appointed Assistant Director of Agricultural Education.

Mr. G. H. Bates, B.Sc., has been appointed Senior Instructor in Agriculture.

Mr. C. E. Grainger has been appointed Instructor in Commercial Horticulture.

Mr. E. V. Beard has been appointed Junior Instructor in Poultry Keeping.

Northamptonshire : Mr. H. L. Webb, B.A., has been appointed Assistant Agricultural Organizer and Warden of the Farm Institute at Moulton, *vice* Mr. A. McVicar, B.Sc., N.D.A., N.D.D.

Mr. R. O. Wood, B.Sc., has been appointed Junior Assistant in Agriculture.

Surrey : Mr. R. Linc, B.Sc., N.D.A., has been appointed Assistant Agricultural Organizer, *vice* Mr. G. T. Morgan, N.D.A., N.D.D.

Miss N. Butchart, N.D.D., B.D.F.D., has been appointed Assistant Instructress in Small Livestock.

Yorkshire (Agricultural Department, University of Leeds) : Mr. A. B. Bates, B.Sc., N.D.A., and Mr. W. W. Ballardie, B.Sc., N.D.D., have been appointed District Lecturers in Agriculture.

Mr. H. J. Moore, B.Sc., N.D.A., has been appointed Assistant Lecturer in Agriculture, *vice* Mr. W. B. Nicoll, B.Sc.

Mr. R. Duncan has been appointed Instructor in Horticulture.

Mr. J. Grainger, B.Sc., has been appointed Assistant Lecturer in Horticultural Botany, *vice* Mr. A. S. Galt.

SELECTED CONTENTS OF PERIODICALS

Agriculture, General and Miscellaneous

Meteorology in Agriculture. (Int. Rev. Agric. (Part I. Mon. Bull. Agric. Sci. and Pract.) **xxi**, 1 (Jan., 1930), pp. 1-3.) [551.5.]

The Utilisation of Refuse. (Int. Rev. Agric. (Part I., Mon. Bull. Agric. Sci. and Pract.), **xxi**, 1 (Jan., 1930), pp. 22-32.) [63.164; 63.60432; 668.6.]

A Suggested Method for the Utilisation of Seaweed. *T. Dillon and E. F. Lavelle*. (Econ. Proc. Roy. Dublin Soc. **ii**, 24 (Sept., 1928), pp. 407-413.) [63.165.]

Soil Survey of Wales, Progress Report, 1927-29. *G. W. Robinson, D. O. Hughes and B. Jones*. (Welsh Jour. Agric., Vol. **vi** (1930), pp. 249-265.) [63.111.]

The Agricultural Ladder and the Age of Farmers. *A. W. Ashby and J. L. Davies*. (Welsh Jour. Agric., Vol. **vi** (1930), pp. 5-19.) [331.]

Horse Labour on Welsh Farms, 1871-1927. *J. L. Davies*. (Welsh Jour. Agric., Vol. **vi** (1930), pp. 42-53.) [63.191; 63.61.]

Studies of Vitamin C in Fresh and Canned Tomatoes. *B. Clow and A. L. Marlatt*. (Jour. Agric. Res., 40, 9 (May 1, 1930), pp. 767-775.) [543.1; 63.513; 664.84.]

Agricultural Economics, Co-operation, etc.

- The Agricultural Credits Act, 1928. *L. le M. Minty*. (Econ. Jour., Vol. **XL**, No. 158 (June, 1930), pp. 248-258.) [332.71 (42).]
- Rent and Stock Carrying Capacity of some Welsh Farms. *J. Pryse Howell and P. George*. (Welsh Jour. Agric., Vol. **VI** (1930), pp. 20-42.) [333.5 (429); 338.1 (429); 63.6.]
- Research Relating to Co-operative Marketing. *O. B. Jesness*. (Jour. Farm. Econ., **XII**, 2 (April, 1930), pp. 233-247.) [334.6.]
- A Review of Agricultural Co-operation in Wales. *J. Morgan Jones*. (Welsh Jour. Agric., Vol. **VI** (1930), pp. 54-67.) [334 (429).]
- The Future of Co-operative Bacon Factories in England. *David Black*. (Pig Breeders' Ann., 1930-31, pp. 28-31.) [334.6; 63.752.]

Field Crops

- Variation in the Quality of Wheat Grown in Replicate Plots. *R. Newton and J. G. Malloch*. (Scientific Agriculture, **x**, 10 (June, 1930), pp. 669-677.) [63.311.]
- Investigations on Yield in Cereals. **VII.**: A Study on Development and Yield of Wheat Based upon Varietal Comparison. *F. L. Engledow and K. Ramiah*. (Jour. Agric. Sci., **XX**, 2 (April, 1930), pp. 285-344.) [63.31; 63.311.]
- Sugar Beet Costs in North Wales. *J. Pryse Howell*. (Welsh Jour. Agric., Vol. **VI** (1930), pp. 86-108.) [63.3433 (42).]

Pasture

- A Comparative Study of the Effects of Artificial Manures on the Botanical Composition of the Herbage in an Old Pasture. *E. Jones*. (Welsh Jour. Agric., Vol. **VI** (1930), pp. 198-208.) [63.33; 63.33-16.]
- The Recovery of Nitrogen in Pastures from the Application of Nitrogenous Manures. *T. W. Fagan and R. O. Davies*. (Welsh Jour. Agric., Vol. **VI** (1930), pp. 208-223.) [63.33; 63.33-16.]
- The Effect of Cutting Sainfoin at Different Stages on the Yield and Chemical Composition of Hay and Aftermath. *T. W. Fagan and J. Rees*. (Welsh Jour. Agric., Vol. **VI** (1930), pp. 224-237.) [63.33; 63.60433.]
- Nationality Trials with Cocksfoot and Observations on the General Bearing of the Relationship of Stem Shoots to Leaf Shoots. *R. G. Stapledon*. (Welsh Jour. Agric., Vol. **VI** (1930), pp. 130-140.) [63.33.]
- Perennial Rye-Grass at Aberystwyth. *T. J. Jenkin*. (Welsh Jour. Agric., Vol. **VI** (1930), pp. 140-165.) [63.33.]
- The Effect of Different Cutting and Manurial Treatments on the Tiller and Root Development of Cocksfoot. *R. G. Stapledon and W. E. J. Milton*. (Welsh Jour. Agric., Vol. **VI** (1930), pp. 166-174.) [63.33; 63.33-16.]
- The Influence of Date of Sowing on the Permanency of Certain Legumes as Constituents of Pastures. *M. T. Thomas*. (Welsh Jour. Agric., Vol. **VI** (1930), pp. 175-182.) [63.33.]
- The Effect of Cutting to the Ground Level upon the Growth of Established Plants of *Dactylis glomerata* and *Phleum pratense*. *M. A. H. Tincker*. (Welsh Jour. Agric., Vol. **VI** (1930), pp. 182-198.) [63.33.]

Fruit

- Physiology of Fruit. **I.**: Changes in the Respiratory Activity of Apples During their Senescence at Different Temperatures. *F. Kidd and C. West*. (Proc. Roy. Soc., Series B., Vol. **106**, No. B742 (Feb. 5, 1930), pp. 92-109.) [58-11; 63.41-198; 664.85.]

Progress Report on Fruit Breeding. *G. T. Spinks*. (Ann. Rept. Long Ashton Agric. and Hort. Res. Stn., 1929, pp. 12-16.) [63.1952; 63.41.]

Families of Strawberry Seedlings Bred for Resistance to Aphis. *G. T. Spinks*. (Ann. Rept. Long Ashton Agric. and Hort. Res. Stn., 1929, pp. 17-27.) [63.27; 63.41.]

Self-Fertility and Self-Sterility in Cider Varieties of Apples. *G. T. Spinks*. (Ann. Rept. Long Ashton Agric. and Hort. Res. Stn., 1929, pp. 28-33.) [58.11; 63.41.]

Root Regeneration upon Transplanted Apple Rootstocks. *T. Swarbrick*. (Ann. Rept. Long Ashton Agric. and Hort. Res. Stn., 1929, pp. 40-46 + 4 pl.) [63.41-195; 63.41.]

The Shape and Quality of Apples in Relation to their Position in the Fruit Cluster: Progress Report. *J. C. Hinton* and *T. Swarbrick*. (Ann. Rept. Long Ashton Agric. and Hort. Res. Stn., 1929, pp. 67-72 + 1 pl.) [63.41.]

Cider-Making

Cider-Making Trials for the Season 1928-29. *O. Grove*. (Ann. Rept. Long Ashton Agric. and Hort. Res. Stn., 1929, pp. 176-195.) [663.3.]

The Effects of Low Temperature Storage on Cider. *B. T. P. Barker* and *O. Grove*. (Ann. Rept. Long Ashton Agric. and Hort. Res. Stn., 1929, pp. 196-199.) [663.3.]

Some Trials with New Types of Cider Filters. *O. Grove*. (Ann. Rept. Long Ashton Agric. and Hort. Res. Stn., 1929, pp. 200-203.) [663.3.]

Plant Pests and Remedies

Crinkle "A," an Infectious Disease of the Potato. *R. N. Salaman*. (Proc. Roy. Soc., Series B., Vol. 106, No. B741 (Jan. 14, 1930), pp. 50-83, pl. 1-4.) [63.23.]

Para-Crinkle: a Potato Disease of the Virus Group. *R. N. Salaman* and *R. H. Le Pelley*. (Proc. Roy. Soc., Series B., Vol. 106, No. B742 (Feb 5, 1930), pp. 140-175, pl. 13-17.) [63.23.]

Studies on Potato Virus Diseases. VII.: Some Experiments with the Virus of a Potato Crinkle with Notes on Interveinal Mosaic. *K. M. Smith*. (Ann. App. Biol. xvii, 2 (May, 1930), pp. 223-240, pl. xvii-xx) [63.23.]

The Chlorotic Disease of the Hop. *E. S. Salmon* and *W. M. Ware*. (Ann. App. Biol. xvii, 2 (May, 1930), pp. 241-247, pl. xxi and xxii) [63.23.]

Streak—A Virus Disease of Tomatoes. *P. H. Jarrett*. (Ann. App. Biol. xvii, 2 (May, 1930), pp. 248-259.) [63.23.]

The Control of Cucumber and Tomato Mosaic Diseases in Glass-houses by the Use of Clean Seed. *W. F. Bewley* and *W. Corbett*. (Ann. App. Biol. xvii, 2 (May, 1930), pp. 260-266.) [63.294; 63.23.]

Spraying Trials against Apple Scab. II.: Season 1929. *J. G. Maynard* and *R. W. Marsh*. (Ann. Rept. Long Ashton Agric. and Hort. Res. Stn., 1929, pp. 155-165.) [63.24.]

Supplementary Note on the Control of Black Currant Leaf Spot. *R. W. Marsh* and *J. G. Maynard*. (Ann. Rept. Long Ashton Agric. and Hort. Res. Stn., 1929, pp. 166-167.) [632.4.]

Dry-Rot of Swedes: Second Progress Report. *T. Whitehead*. (Welsh Jour. Agric., Vol. vi (1930), pp. 289-295.) [63.24.]

Control of Root Flies in South Wales. *H. W. Thompson*. (Welsh Jour. Agric., Vol. vi (1930), pp. 295-301.) [63.27.]

The Common Green Capsid Bug (*Lygus pabulinus*) as a Pest of Sugar Beet. *C. L. Walton* and *L. N. Staniland*. (Ann. Rept.

- Long Ashton Agric. and Hort. Res. Stn., 1929, pp. 99-100+1 pl.) [63.27.]
- The Raspberry and Loganberry Beetle and its Control: Some Experiments with a Pyrethrum Emulsion Spray. *C. L. Walton*. (Ann. Rept. Long Ashton Agric. and Hort. Res. Stn., 1929, pp. 115-123.) [63.27; 63.295.]
- Experiments on the Control of Pear Midge (*Contarinia pyrivora*). Progress Report. *L. N. Staniland* and *C. L. Walton*. (Ann. Rept. Long Ashton Agric. and Hort. Res. Stn., 1929, pp. 124-129.) [63.27.]
- On the Biology of the Gall-Midges (Cecidomyiidae) attacking Meadow Foxtail Grass (*Alopecurus pratensis*), including the Description of one New Species. *H. F. Barnes*. (Ann. App. Biol. xvii, 2 (May, 1930), pp. 339-366.) [63.27.]
- Insects found associated with Cacao, Spices and Dried Fruits in London Warehouses. *O. W. Richards* and *G. V. B. Herford*. (Ann. App. Biol., xvii, 2 (May, 1930), pp. 367-395, pl. xxiii-xxxii.) [63.27.]
- Observations on the Diseases of Market Garden Crops in the Vale of Evesham. *L. Ogilvie*. (Ann. Rept. Long Ashton Agric. and Hort. Res. Stn., 1929, pp. 149-154.) [63.23; 63.24-51; 63.27-51.]
- The Economics of Spraying Fruit Trees. II.: The Cost of Summer and Winter Washing, 1929 and 1930. *J. G. Maynard*. (Ann. Rept. Long Ashton Agric. and Hort. Res. Stn., 1929, pp. 168-175.) [63.294; 63.41.]
- Investigations on the Fungicidal Action of Sulphur. IV.: Third Progress Report. *B. T. P. Barker*. (Ann. Rept. Long Ashton Agric. and Hort. Res. Stn., 1929, pp. 130-148+1 pl.) [63.295.]
- Further Observations on a Pyrethrum Spray Fluid. *F. Tutin*. (Ann. Rept. Long Ashton Agric. and Hort. Res. Stn., 1929, pp. 93-95.) [63.295.]
- Examination of Plants for Insecticidal Principles—I. *F. Tutin*. (Ann. Rept. Long Ashton Agric. and Hort. Res. Stn., 1929, pp. 96-98.) [63.295.]
- The Principles of Biological Control. *W. R. Thompson*. (Ann. App. Biol., xvii, 2 (May, 1930), pp. 306-338.) [63.296.]
- Live Stock and Feeding**
- The Production and Marketing of Pigs in North Wales and Cardigan. *T. Lewis*. (Welsh Jour. Agric., Vol. vi (1930), pp. 67-86.) [63.6: 38; 63.64.]
- Reproductive Disturbances caused by Feeding Protein-deficient and Calcium-deficient Rations to Breeding Pigs. *H. R. Davidson*. (Jour. Agric. Sci., xx, 2 (April, 1930), pp. 233-264.) [612; 612.394; 63.64: 043.]
- The Value of Sugar-beet Pulp and Potatoes in Pig Feeding. *J. A. Thompson*. (Pig Breeders' Annual, 1930-31, pp. 129-131.) [63.60432; 63.64: 043.]
- Observations on the Nutrition of Breeding Pigs. *J. B. Orr* and *H. R. Davidson*. (Pig Breeders' Ann., 1930-31, pp. 53-57.) [612.394; 63.64: 043.]
- Feeding Ensilage to Sheep: Some Successful Experiences by Farmers. (New Zealand Jour. Agric., xl, 4 (April 22, 1930), pp. 251-255.) [63.60432; 63.631: 043.]
- The Invention of a New Wood Feed Product in Germany. (Jour. Farm Econ., xii, 2 (April, 1930), pp. 340-342.) [63.60432.]

THE JOURNAL OF THE MINISTRY OF AGRICULTURE

Vol. XXXVII. No. 7.

OCTOBER, 1930.

NOTES FOR THE MONTH

NATIONAL Rat Week has been fixed this year for the week commencing Monday, November 3, and the Ministry has again addressed a circular letter to all the local authorities who exercise powers and duties under the Rats and Mice (Destruction) Act, 1919, impressing upon them the desirability of making a special effort during that week to secure concerted action for the destruction of the pests.

**National
Rat Week,
1930**

It is generally recognized throughout the country that the depredations of rats cause immense loss, both directly in the destruction and contamination of foodstuffs and material and indirectly as agents and carriers of disease ; and although many local authorities do their utmost throughout the year to carry out the provisions of the Act, there are some who do not appear to be sufficiently alive to the gravity of the subject. It is of the utmost importance that systematic action should be taken by all occupiers of land and buildings, and by local authorities and those who control large farms, estates, factories, industrial premises, etc.

A number of suggestions for concerted action and methods of procedure, specially suitable for application under various conditions, are contained in the Ministry's circular letter ; and in view of the considerable interest taken in the Ministry's Rat Repression stand at the recent Fourth World's Poultry Congress at the Crystal Palace, London, local authorities have been asked to pay particular attention to poultry farms and their surroundings. In order to assist in the campaign, the Ministry has offered to lend to local authorities copies of its cinematograph film, entitled "The Rat Menace" ; some of the copies have recently been revised in order to make the film more suitable for exhibition in rural areas. A set of lantern slides, together with a suitable accompanying lecture, can also be borrowed for this purpose. Copies of a pamphlet, giving the names of firms prepared to supply rat destruction preparations and materials, have been supplied

to local authorities. This pamphlet, which also contains some simple suggestions for rat destruction, is suitable for distribution to the general public, and the Ministry has suggested to authorities that copies of the pamphlet should be made for that purpose. Useful suggestions and advice are also contained in the Ministry's Leaflet, No. 244, on the destruction of rats, single copies of which are supplied free of charge on application, whilst quantities can be obtained at the rate of 6d. per dozen.

A more comprehensive publication, *Rats and How to Exterminate Them* (Miscellaneous Publication No. 51), may also be obtained from the Ministry at the price of 3d., post free. This publication of 18 pages contains nine illustrations.

The Ministry is always prepared to give assistance and advice in any cases of rat infestation which present features of unusual difficulty.

THE Annual Report of the work of the Land Division of the Ministry for the year 1929 has recently been published.

**Report of the
Land Division,
1929**

The section of the Report dealing with small holdings reviews, generally, the operations of county councils in England and Wales during the three years since the passing of the Small Holdings and Allotments Act, 1926. The causes of the slow progress in providing additional holdings are briefly discussed, and reasons advanced for the adoption by councils of a more active policy. Statements are included showing the applications for holdings received and the number of holdings provided by each council during the year 1929, together with a table giving the total area held by each council for the purpose of small holdings at December 31, 1929.

Under the heading of "Allotments," the Report summarizes the returns received from allotment authorities at December 31, 1929, and includes statements of the total number and acreage of allotments provided in the areas of each of the different classes of allotment authority. Other matters discussed are the provision of land for allotments in Town Planning Schemes and the effect on the demand for allotments of the provision of comparatively large gardens with houses erected under the Housing Acts.

Under the provisions of the Small Holding Colonies Acts, 1916 and 1918, and the Sailors and Soldiers (Gifts for Land

Settlement) Act, 1916, the Ministry administers six estates with a total area of nearly 11,000 acres. Most of the estates are divided into small holdings and allotments, but 2,200 acres on one estate are cultivated as a profit-sharing farm. The Report gives financial statements for each scheme and describes briefly the position and progress of the settlers on each estate during the 1929 cropping season.

The Improvement of Land Acts empower landowners, with the approval of the Ministry and subject to certain conditions, to borrow money for the purpose of effecting authorized improvements of land on the security of a rent-charge which takes priority over most other charges on the estate. A brief account is given of the operations of the Ministry under the Acts during the year 1929, and a table is appended showing for each year since 1912 the total amount charged on estates in England and Wales during the year in respect of each of the principal types of improvement authorized by the Acts.

Further sections of the Report record proceedings through the Ministry, under the Property Acts, 1922 and 1924, in connexion with the extinguishment of manorial incidents, and under the Law of Property Act, 1925, and the Landlord and Tenant Act, 1927, with the apportionment and redemption of rents.

The Report also enumerates the various schemes for the regulation of commons approved by the Ministry during the year, and specifies the areas of common land and open spaces enclosed for special purposes with the consent of the Minister. Particulars are given of deeds of declaration deposited with the Ministry under the Law of Property Act, 1925, for the purpose of conferring upon the public rights of access to certain commons for air and exercise, and of the orders issued by the Ministry imposing limitations and conditions as to the exercise of such rights. The total area of commons affected by the deposit of deeds under this Act up to the end of 1929 was 9,467 acres.

The quinquennial reports made to the Ministry in 1929 by trustees of recreation grounds allotted under Inclosure Awards are briefly reviewed, and the Ministry's action thereon indicated.

The Report also gives details of the transactions effected with the Ministry's approval under the Glebe Lands Act, 1888, and the Universities and College Estates Acts, 1858 to 1925, and some account is given of the more interesting changes effected during the year in the nature of properties held by

the universities and colleges concerned, and of their investments.

A section of the Report dealing with transactions under the Tithe Acts, 1836 to 1925, includes an estimate of the amount of tithe rentcharge now existing and in the hands of the various classes of titheowners, together with details of the number of redemptions, mergers, altered apportionments, etc., of tithe rentcharge and other similar charges effected under the Acts.

Among other contents of the Report are statistical details of the work undertaken by the Ministry under Acts affecting agricultural holdings since 1921; a section dealing with the destruction of rats and mice and the measures taken during "National Rat Week"; particulars of the schemes which the Ministry has been authorized to assist financially in connexion with field drainage, water supply, and the claying of fen lands; and a note on the constitution of county agricultural committees established in pursuance of the Ministry of Agriculture and Fisheries Act, 1919, and on the activities of these committees under the Rent Restrictions Acts in connexion with agricultural cottages, and in relation to the destruction of injurious weeds.

* * * *

THE Travelling Poultry School is a feature in the Agricultural Education programme of Devonshire that deserves wider notice. It was started many years ago

Devon Travelling Poultry School to provide education in poultry-keeping for the remote parts of the county; and such has been its success that it was found necessary this year to appoint a whole-time instructress for the work. The School travels to a number of centres each year, and at each centre a thirty-hour course, extending over three weeks, is given. Conditions and circumstances naturally vary at the different centres, but the scheme of education is, broadly, the same in all cases. At each centre, fifteen pupils, on the average, are taken, and they are drawn from a zone, roughly, within two to three miles of the centre.

The School provides a hatching and rearing plant in miniature, lectures and demonstrations being given throughout the course; but pupils are expected, after the first few days, to take part under supervision in the routine work. Material for a course is provided by the purchase of eggs and day-old chicks from station holders under the County Approved Poultry Breeding Scheme. At the end of the three weeks, the

stock that has been reared is sold locally ; and it is a tribute both to the quality of the stock and to the management that rearing losses are kept within a low figure. Last year it was under 2 per cent. With the aid of a cramming machine of the ordinary Sussex type, instruction in the fattening and marketing of poultry is also given, and each pupil is expected to pluck, press, draw and truss three birds. During a course, visits are paid to one or more well-known poultry farms within reasonable distance ; and these excursions, which give many of the pupils their first idea of poultry farming as a commercial undertaking, are much appreciated.

At the end of a course, the sole expense of which to the pupil is an entrance fee of 2s. 6d., there is a written and practical examination, prizes and certificates being awarded to pupils showing proficiency.

The School has undoubtedly proved of distinct educational value in Devonshire. As a tangible instance may be cited the case of a general farmer who had not realized the possibilities of poultry farming until he became greatly interested in a course that was being held in his neighbourhood. As a consequence, he extended both his stock and his plant, and, in this year's County Laying Trials, entered a pen of White Wyandottes which, at the end of the first half-year, averaged 135 eggs per bird.

Further information about the School may be obtained by those interested on application to the Agricultural Organizer for Devon, 1, Richmond Road, Exeter.

THE value of official statistics seems to require no emphasis at a time when so many matters of paramount importance are equally conspicuous in the public interest. Reliable information upon such vital topics as the position of trade and agriculture, the incidence and trend of unemployment, the state of the public health, and the development of methods of transport by land, sea and air is essential to the ordinary member of the community no less than to the man or woman engaged in the organization of national or local activities.

Equally necessary is the provision of a handy and inexpensive means to enable the inquirer to discover which of the many Government publications issued year by year furnishes the statistics required for his particular purpose.

Such a means is provided by the Guide to Current Official Statistics, which consists not only of an annual catalogue of official publications containing statistics, but also of a detailed index to their contents, arranged under subject headings in such a manner that the nature of the information available on any topic can be ascertained with ease and celerity.

Volume Eight of the Guide (price 1s. net, post free 1s. 5d., pp. 316) has just been issued and may be obtained direct from H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2, or through any bookseller.

* * * * *

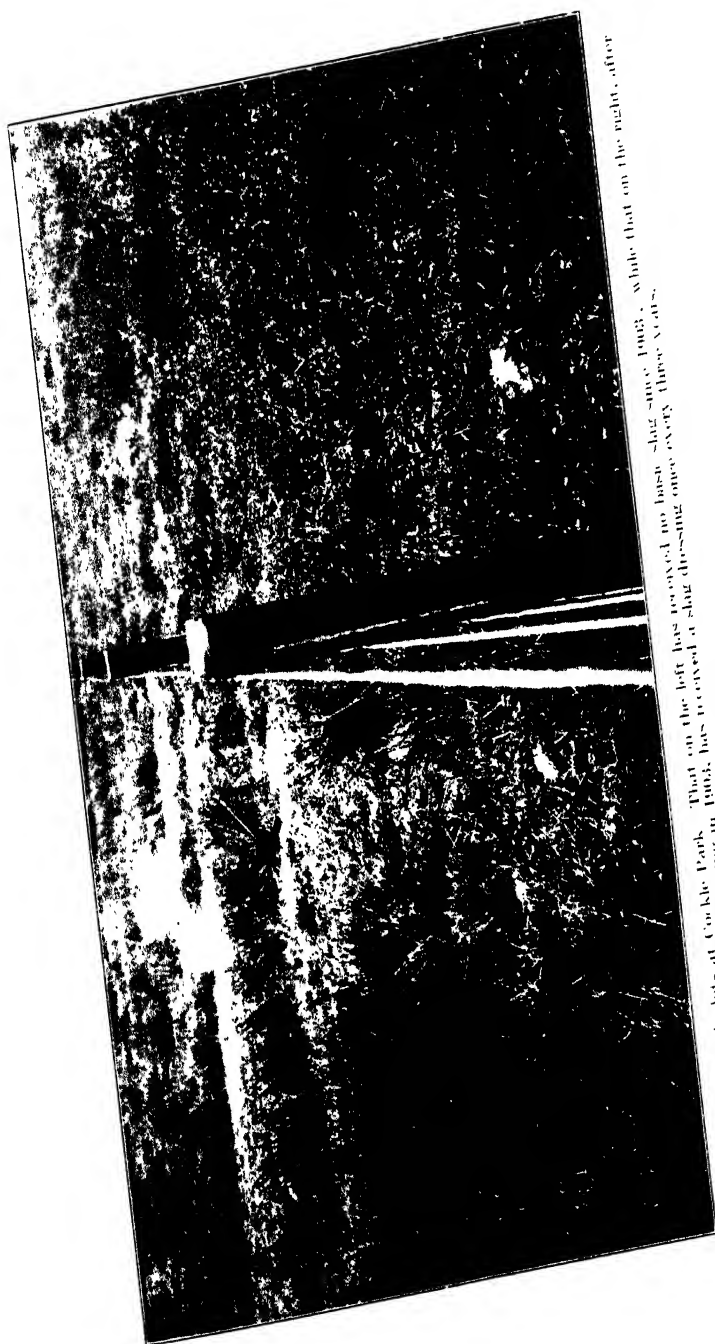
THE following note has been communicated by Mr. H. Cecil Pawson, Lecturer in Agriculture, Armstrong College,

Newcastle-upon-Tyne :—In recent years,

**Effect of Basic
Slag on
Rush Growth**

one of the chief features of interest to visitors inspecting the grassland trials at Cockle Park is the effect of slag treatment on the growth of rushes. The two plots

shown in the photograph do not possess any artificial form of drainage. Both received a heavy dressing of basic slag in 1903, but since that year the plot on the left has not received any further dressing of phosphates, whilst that on the right of the dividing fence has received slag once every three years. Cake is fed to the cattle and sheep grazing on the left-hand plot during the experimental grazing period each season. As a result, through lack of phosphates, and continuous nitrogen treatment arising from the cake feeding, the herbage on this plot has become poor in feeding value ; the stocking of the plot has had to be considerably reduced in consequence, and the top of the riggs presents a matted, harsh condition. Examination of the soil after heavy rain shows that the water has scarcely penetrated the top of the riggs, but is largely shed off and, hence, tends to accumulate in the furrows. In the furrows, rushes grow vigorously, being tolerant of wet conditions. The striking observation is that the rush growth ceases at the dividing fence, for where the slag treatment has been pursued no rushes are to be found in the furrows, although no pipe or mole draining of any kind has been carried out on either plot. There are, no doubt, several causes contributing to this effect. The large and even development of clover, which is maintained in vigorous condition on the slagged plot, gives rise to better quality herbage ; thus this area is much more closely and evenly grazed, which fact, in turn, tends to retard rush growth. The natural drainage is also greatly im-



View of two glassland plots at Cuckle Park. That on the left has received no basal slag since 1963, while that on the right, after the dressing in 1963, has received a slag dressing once every three years.

EFFECT OF BASAL SLAG ON RUSH GROWTH.

proved by the mass of fibrous clover root opening up the soil; this is evidenced by the fact that the rain water gets down into the soil on the riggs as well as in the furrows, hence there is little accumulation in the latter, the rainfall being more evenly distributed over the total area. Further, the denser growth of herbage on the slag-manured plot which, after grazing, soon makes further growth, must result in greater evaporation of moisture from the leaf surface as compared with the no-slag plot, where the herbage is much more scanty and, once grazed, makes little further growth that season.

Artificial drainage in some form is necessary on wet clay land if sound wintering conditions for stock are desired. The lesson of this ocular demonstration, however, is that, where drainage may not be practicable for the present at least, much can be done to improve the grazing conditions by judicious manurial treatment backed up by adequate stocking. It is noticeable that the best development of clover from phosphate treatment on unimproved land is always secured when there is plenty of moisture present, and, as demonstrated in this instance, the development of a healthy, vigorous clover plant assists in dealing with the problem of excess moisture in the soil.

* * * * *

THE following note, supplementary to one published in the August, 1930, issue of this JOURNAL (p. 417), has been communicated by Mr. V. C. Fishwick,

Rations for P.A.S.I., N.D.A., N.D.D., South-Eastern
In-Pig Sows Agricultural College, Wye :—

Many breeders are feeding to their in-pig sows rations which contain 10 per cent. of fish meal or other protein supplement. It was stated in the JOURNAL for August that during the past winter satisfactory results had been obtained in the College experimental herd with a ration in which the fish meal was reduced to 5 per cent. During the past summer, in the case of sows which had a free range at grass, it has been found possible to omit the fish meal or other protein supplement altogether for the first three months of the gestation period. Normal healthy pigs of average weight at birth have been produced by large black sows run on grass, which have received from weaning to within three weeks of farrowing 3 lb. per head per day of a mixture of 45 per cent. barley meal, 10 per cent. maize germ meal, and 45 per cent. sharps, with $1\frac{1}{2}$ lb. of chalk and $\frac{1}{2}$ lb. of salt added to each 100 lb. of meal. The ration given during the last three

weeks before farrowing was 40 per cent. barley meal, 10 per cent. maize germ meal, 45 per cent. sharps, and 5 per cent. fish meal, with $1\frac{1}{2}$ lb. of chalk and $\frac{1}{2}$ lb. of salt added to each 100 lb. of meal.

Apart from the fact that an excess of protein in the ration of in-pig sows is undesirable it may be pointed out that by reducing the fish meal from 10 to 5 per cent. during the winter months and omitting it altogether during the summer a saving of 10s. per sow per annum is effected.

* * * * *

THE 11th Annual Report of the Official Seed Testing Station for England and Wales, covering the period from August, 1927, to July, 1928, appears in No. 3,

Report of the Vol. II, of the Journal of the National
Official Seed Institute of Agricultural Botany, copies of
Testing Station which may be obtained from the Institute,
Huntingdon Road, Cambridge, price 2s. 6d.

each, or post free 2s. 9d.

During the period under review, the total number of samples received for analysis reached 26,583, a figure exceeding the total of any previous season and equivalent to an average of approximately 511 samples per week, or of 85 per working day. The source of the samples, together with comparative figures for the previous seasons, are as follows:—

	1927-28	1926-27	1925-26
<i>Seed firms :</i>			
Number sending samples	1,759	1,610	1,732
Number of samples received	20,473	17,673	18,375
<i>Farmers, etc. :</i>			
Number sending samples	871	701	676
Number of samples received	1,905	1,374	1,404
<i>Public Departments :</i>			
Number of samples received	4,205	3,790	3,105
Total number of samples	26,583	22,837	22,884

The 1927-28 figures show an all-round increase: 9 per cent. in the case of seed firms sending samples, 15 per cent. in the number received from seed firms, whilst a 24 per cent. increase is shown in the number of farmers using the Station, and 38 per cent. in the samples sent by them. An analysis of the samples shows the following distribution according to the related species compared with similar figures for the previous seasons:—

	1927-28	1926-27	1925-26
Cereals	10,616	8,228	8,402
Pulses	2,452	1,975	2,601
Roots and vegetables	5,781	5,182	4,954
Clovers	4,578	4,727	4,280
Grasses	3,034	2,508	2,418

The number of cereal samples shows an increase of 29 per cent. over the previous season's figures; pulses an increase of 24 per cent.; grasses 21 per cent.; and root and vegetable seed samples 11.5 per cent. Clover samples, on the other hand, show a decrease of 3.1 per cent.

The particulars of samples received each month follow in general outline the average of the nine previous seasons, and were as follows:—

1927-28				1927-28			
August ..	..	..	379	February ..	..	..	5,135
September ..	..	..	1,272	March ..	..	..	5,613
October ..	..	..	3,352	April ..	..	..	2,217
November ..	..	..	2,342	May ..	..	..	808
December ..	..	..	1,840	June ..	..	..	296
January..	..	..	3,167	July ..	..	..	162

Cereals.—The average percentage germination of cereals shows a falling off when compared with the previous season's figures. The average germination of wheat (93.9 per cent.) was, in fact, lower than in any previous season with the exception of 1924-25. The average for barley was 94.1 per cent., oats 92.9 per cent. and rye 89.9 per cent.; 9.6 per cent. of the wheat samples and 10.9 per cent. of the barley samples gave germination results below the authorized minimum.

A naked eye examination showed that 7.3 per cent. of the wheat samples were infected with Bunt and 3.7 per cent. with Earcockle. Ergot was found in 1 per cent. of wheat and 37.8 per cent. of the rye, and Smut in 10 per cent. of the barley samples. The percentage of samples of rye infected with Ergot was greater than in any previous season recorded. It should be noted, however, that the quantity of Ergot found in the majority of samples of both wheat and oats was small.

A table is included in the Report showing the distribution of cereal samples received for test arranged according to variety. Red Standard again heads the list of the wheats, Plumage Archer of the barleys, and Victory of the oats.

Pulses and Root and Vegetable Crop Seeds.—The average germination of the pea samples (85.9 per cent.) was identical with that of previous seasons. Field and broad beans were below the average, but runners showed an improvement (82.4 per cent.) when compared with the average of the previous seasons. The averages of the turnip and mangold samples were slightly below the average for 1917-1927, but there was an improvement in the swedes. With the exception of onion (61.7 per cent. as compared with an average of 66.8 per cent.) improvement was shown in the average germination of all the garden seeds.

Grasses.—The average purity of grasses showed a slight improvement over the previous season, but was still below the average of the six previous seasons. The average purity of Italian ryegrass samples was lower than in any of the previous six seasons, and the percentage of samples containing 1 per cent. or more of injurious weed seeds was greater than in either of the two previous seasons. The germination of Cocksfoot (88.2 per cent.) was almost the lowest for the past six seasons, but the purity was a little higher than the average. Timothy showed an improvement both as regards purity and germination.

Clovers.—The average purity of all samples of Red clover was almost the lowest yet recorded, and the germination (70.6 per cent.) was lower than in any season since 1917-18. White clover gave an average purity rather below the average of the previous seasons and there was a marked falling off in the average germination (69.1 per cent.). Wild white clover gave an average germination of 63.7 per cent., as compared with an average of 74.5 per cent. in the seasons 1917-1927, an average of 7.6 per cent. of hard seeds as compared with 12.9 per cent., and an average of impurities of 10 per cent. as compared with 9.38 per cent.

The percentage of samples of English Red clover containing Dodder (3.4 per cent.) was slightly lower than in the previous season (3.6 per cent.). 13.9 per cent. of the French and 86.6 per cent. of the Chilean Red clover were found to contain this weed.

Investigations.—In addition to the normal tests, particulars of which are given at the beginning of this note, some 3,410 tests of an investigational nature were carried out at the Station during the course of the season. Laboratory and field studies have also been carried out in connexion with Wild White clover, abnormal and defective growths of Brassicas, seed-borne diseases, and provenance studies of Red and White clover.

The Report also includes a copy of the papers set in the examination in the principles and practice of seed testing which was held at the Station in July, 1928.

* * * * *

THE following note has been communicated by the Department of Agriculture and Horticulture of the University of Bristol. Complaints having been received

**The Control
of Moles**

concerning damage done by moles to permanent pastures, drainage embankments, etc., the Department arranged to ascertain the value of certain materials, known to be effective

rodent controls, for the purpose of ridding badly infested areas of moles where the use of other poisonous substances is undesirable or impracticable.

By the courtesy of Mr. H. B. Napier an area of mole-infested land in Ashton Park (near Bristol) was placed at the disposal of the investigators* and the experiments described below were commenced during March, 1928.

A trench 1 yd. wide and 1 ft. 6 in. deep (*i.e.*, down to the mountain-limestone rock) was dug all round the area, enclosing approximately 2,500 square yards. Fine mesh wire netting was erected in the inside of the trench and turned into the soil so as to prevent the moles from leaving or re-entering the area. The wire netting extended above the ground to a height of 2 ft. 6 in. The whole area was further enclosed by means of a barbed-wire fence to keep off sheep and deer.

Baits prepared from Red Squill (*Urginea maritima*) were put down in this area on April 3, 1928. One hundred and ninety grammes of earthworms were treated with a mixture of equal parts of fine flour and red squill powder weighing $42\frac{1}{2}$ grammes, so that each bait contained approximately 10 parts per hundred of red squill powder. The object of using flour was to enable the squill powder to adhere better to the worms.

At the same time 150 baits consisting of shredded meat which had previously been soaked for twenty-four hours in liquid red squill were prepared. These were made from 250 grammes of meal, 210 grammes of shredded meat, together with 212.5 grammes of liquid red squill giving a total weight of 672.5 grammes of material. This material was divided into 150 baits, an average weight of $4\frac{1}{2}$ grammes per bait, which gave an equivalent of 10 parts per hundred of red squill powder.

Immediately following manufacture, the baits were inserted into the runs by the following methods: Two baits were placed in each hole, a ticket indicating the nature of the bait used being placed near the point of insertion. In all, 237 baits were inserted in this way.

After a period of 14 days the baits were inspected in order to count the number that had been taken. Of the 143 meal and meat baits, 95 were taken by moles, and, of the 94 worm baits, 59 were taken; that is about 65 per cent. of baits laid were taken by moles.

All the hillocks were counted at the time of baiting, and it was found that there were 295 on the enclosure. These were then levelled down in order to ascertain whether fresh workings occurred in the circumscribed area.

* Messrs. A. W. Ling and C. A. MacEacharn (Bristol University) with Mr. E. C. Read (Ministry of Agriculture).

On the following dates fresh molehills were levelled down :— April 24, 75 ; April 25, 10 ; May 8, 59 ; June 1, 6 ; June 15, 9 ; September 12, 3 ; December 17, 0.

On January 12, 1929, the wire netting was lifted to allow moles access to the experimental area, but on this date and on further inspections on January 17 and September 6, 1929, no fresh workings had occurred, and since the middle of September, 1928, there have been no further workings. At this time, there was a certain amount of activity on the part of the moles in the area surrounding the plot, and therefore a few traps of the usual type were inserted around the plot. This proved to be quite satisfactory, as several moles were caught in these traps. After the wire netting was removed from one side of the plot on January 12, 1929, moles which were working freely outside the experimental plot did not penetrate into this area, and up to January, 1930, there was no evidence of re-infestation except at the top end of the area close to a water reservoir where a mole had burrowed underneath the wire netting and had continued its activities along one of the old runs. This mole was subsequently trapped. Baiting with red squill would appear to have proved satisfactory, although it must be pointed out that the drought of the year 1929 probably prevented the moles from becoming very active on the plot. At one period, just after the lifting of the wire, there was evidence that one or more moles had gained access to the enclosed area, as runs appeared following the lines of the old workings which had been in use before the experiments started.

Before the wire was lifted, every visible mole run in the area was carefully dug out by means of long-handled spades and trowels, but no dead mole was found in any part of the run, and it is presumed that the action of red squill on moles is the same as that on rats, *i.e.*, that it drives them somewhere in search of water, and presumably the moles left the surface runs and went much deeper.

At the same time as the experiments with baits described above were carried out (*i.e.*, in April, 1928), two areas (one of which was very damp), measuring 950 sq. yd. and 1,500 sq. yd. respectively, were gassed without the sites being subjected to any form of preparation. The gases employed were on one plot Cyanogas (calcium cyanide) and on the other Horo (compound of sulphur and other substances). Whilst the first treatment with Cyanogas was not satisfactory, a further gassing of the plot in November, 1928, when 178 molehills were levelled down, proved successful, and on December 17,

1928, no more molehills were found on the gassed site, while, in a very narrow strip surrounding this area, 167 new hills were counted. Similar results were obtained with Horo gas. It appeared evident that some of the moles had retreated from the gassed areas.

Conclusions.—From the foregoing experiments, it would appear that baits prepared from red squill, either as a liquid or powder, are satisfactory for ridding badly-infested areas of moles ; but it must be pointed out that these baits must be prepared with considerable care, particularly as regards handling, and also that they must be inserted into the run with the minimum amount of disturbance of the run. It was found, by a smaller experiment, that where a run was very much disturbed, or where the naked hand had rubbed on the soil of the burrow, the mole escaped from the run just near to this point by means of a small run made to the surface. It appears also that gassing will drive the moles from the runs ; but, for satisfactory results, it is obviously necessary to carry out this work when the moles are actually in the runs, otherwise the gas leaves a solid deposit in the runs, and although the actual area does not become re-infested, some of the moles carry on their activities around the treated area.

In gassing mole-infested areas, it is necessary that the retreats of the moles under banks or in woods should be gassed as well as the actual outside runs.

Trapping, with all its limitations, is quite satisfactory in the hands of an experienced person. On large estates, or where there is sufficient work to justify the employment of a professional mole catcher, trapping is recommended.

The investigators' thanks are due to the Ministry of Agriculture and Fisheries for a grant in aid of this work ; to H. B. Napier, Esq., J.P., for allowing the investigation to be conducted in Ashton Park ; and also to colleagues who assisted in certain sections of the field work.

* * * * *

THE Ministry still has available copies of coloured diagrams of four common pests and diseases of fruit trees, etc., these showing 1, the Apple Blossom Weevil ;
Coloured Diagrams 2, Winter Moths ; 3, Apple and Pear Scab ;
of Some Pests and 4, Silver Leaf. The diagrams, in size
and Diseases of 30 in. by 20 in., are finely produced by the
Fruit Trees four-colour process, and are not only technically clear and accurate but artistically attractive. Suitable for display on walls, they afford an

easy means of identifying the characteristic damage caused by the respective insect and fungus pests, and should be very helpful to fruit growers, allotment societies, local educational authorities for use in rural schools, and for lecturing purposes. The diagrams are supplied in sets of four, and can be obtained, price 9s. unmounted or 15s. mounted on rollers, post free, on application to the Ministry, 10 Whitehall, London, S.W. 1.

THE Ministry has for some time had under consideration the form in which its leaflets and priced publications are issued. It has now been arranged

New Series of Bulletins and Leaflets	that the existing Leaflets, Miscellaneous Publications, Research Monographs and Sectional Volumes of Leaflets shall be gradually replaced by two new series of publications, viz.: "Advisory Leaflets" and priced "Bulletins."
---	--

Advisory Leaflets will consist of brief, simply-written statements on the subjects treated. As existing leaflets come up for revision they may be withdrawn, or be re-issued as *Advisory Leaflets*, and/or, if the subject warrants it, be extended into *Bulletins*.

Subject to certain safeguards for the avoidance of waste, the restrictions hitherto imposed on free distribution will be modified as regards *Advisory Leaflets* (and leaflets at present in being). Full particulars will be found in the revised list of the Ministry's Publications, a copy of which can be obtained free on application.

The *Bulletins* will replace the existing series of Sectional Volumes, Miscellaneous Publications and Research Monographs, and will not only deal with new subjects but will in time cover such of the existing leaflets as require fuller treatment than is possible in leaflets intended for advisory purposes. As part of the new scheme, it is intended also to improve the whole standard of production, by means of better type and paper, improved covers, and, in some cases, by the introduction of coloured plates. The majority of the volumes will be illustrated.

The following *Bulletins* are now available and may be obtained, post free, at the prices mentioned :—

*1. *Some Diseases of Farm Animals*.—Illustrated. Price 1s. 6d.

*3. *The Improvement of Grassland*.—Price 8d.

4. *Fruit Production: Soft Fruits and Nuts*.—Illustrated. Price 1s.

*5. *Commercial Fruit Tree Spraying and what it Costs*.—Illustrated. Price 6d.

*6. *Diseases of Poultry*.—Illustrated. Price 8d.

7. *The Scientific Principles of Poultry Feeding*.—By E. T. Halnan, of the School of Agriculture, Cambridge. Price 8d.

8. *Poultry Keeping on the General Farm*.—Illustrated. Price 8d.

*12. *The Culture of Fish in Ponds* (2nd edition).—A summary of successful methods employed in fish farming countries. Price 4d.

*16. *Variations in the Composition of Milk*.—An authoritative summary of the causes. Price 4d.

17. *County Egg Laying Trials in England*.—Price 1s. 6d.

18. *Table Poultry Production*.—A report on the experiments conducted under the National Poultry Institute Scheme at the S.E. Agricultural College, Wye, Kent. Illustrated. Price 1s. 6d.

19. *Poultry Breeding for Egg Production: The Effects of In-Breeding*.—A report on the experiments conducted under the National Poultry Institute Scheme at the Cheshire School of Agriculture, Reaseheath. Price 6d.

The publications, the titles of which are indicated by an asterisk, have already appeared in a different form, but are now re-issued in improved or revised editions in the new series.

* * * * *

FOR a considerable time past the Ministry has been able, by arrangement with the British Broadcasting Corporation, to broadcast a weekly bulletin of market prices each Thursday between 6.35 and 6.40 p.m. from most of the regional and relay stations; and, more recently, to broadcast from Daventry after 9 p.m. each evening (except Thursday and Sunday) the fat stock prices at certain selected markets.

With the object of simplifying its programmes, however, the Corporation has decided, as from Monday, October 6, to transmit the bulletins at the same time each evening and from all stations. From that date the daily bulletins of Fat Stock Prices will be broadcast from all stations at approximately 6.38 p.m., that is, immediately after the London Stock Exchange Report on Mondays, Tuesdays, Wednesdays and

Fridays, and immediately after the First General News Bulletin on Saturdays. The Thursday evening bulletin of Market Prices for Farmers will continue to be broadcast as at present, between 6.35 and 6.40 p.m., but the London bulletin which is now relayed by Belfast and Plymouth will in future be broadcast also from the London and Midland Regional transmitters.

The net effect of these changes is that farmers will be able to hear the Fat Stock Prices each evening at about 6.38 p.m. either from their Regional transmitter or from Daventry.

* * * * *

THE demonstrations of horticultural machinery, carried out by the Ministry in collaboration with County Authorities, in the spring of 1929, and again in April and May of this year, attracted widespread attention in the areas surrounding the centres at which the demonstrations took place. It is evident that an increasing interest is being taken in tractors and implements adapted for work in orchards, and the Ministry proposes to arrange a further series of demonstrations to take place in the spring of 1931.

It has already been pointed out in this JOURNAL (October, 1929, p. 606) that cultivation machinery for use in orchards is subject to certain limitations which do not apply in the case of machinery used in open field work. This fact is appreciated by manufacturers, and it is satisfactory to be able to record that the tractors and implements demonstrated in the spring of this year were in many cases better adapted for the work in view than those used in the demonstrations of 1929. There still appears, however, to be scope for adaptations and new construction, and it is to be expected that the power units and implements demonstrated next spring will show further improvements in design.

Much has been learnt from the demonstrations that have already taken place, but nothing of greater importance than the need for adequate power in the tractors used. Low-powered machines and small implements have their sphere of usefulness in horticultural work, but no one would claim that they should be used for the principal cultivation operations in the larger orchards.

It cannot be too firmly emphasized that for these operations a tractor of similar power to that required for open field work is a necessity.

SOIL SURVEYS AND THEIR UTILIZATION

PROFESSOR LINWOOD L. LEE, B.S.

(of the *Agricultural Experiment Station, New Jersey, U.S.A.*),
Rothamsted Experimental Station.

FOR some years past, many countries of the world have engaged in the making of soil surveys. Various methods have been suggested and tried, and numerous reports published. Of special interest is the work in the United States which, for the past thirty years, has proceeded without interruption under the guidance of the Bureau of Soils and, later, of the Bureau of Chemistry and Soils of the United States Department of Agriculture, in co-operation with the various States. This work has been very extensive and has covered all parts of the Union. It has also embraced the surveying of a great variety of agricultural, climatic, and soil conditions, so that it might well be considered an outstanding example of the successful application of soil surveys to the classification of the soils of a nation. There are no available data regarding the extent of the soil surveys completed to date within the United States, but, up to and including the year 1912, the survey of over 333,000,000 acres had been completed. It is impossible to say what acreage has been added during the past seventeen years, but it is quite possible that the present surveys would show published work concerning well over 600,000,000 acres.

A soil survey may be defined as the identification, classification, and mapping of the various soils of any given district. It should embody fundamentally a detailed study of their present and possible future utilization—the methods of cultivation and fertilization now in use on the various soil types, and suggestions for their improvement. Such important factors as crop adaptations and systems of farming as applied to the different soils also receive careful consideration. The soils recognized are then classified and their occurrence and distribution accurately recorded on a map. The completed soil survey with the accompanying report and map represents a complete inventory of the soils of the particular district, together with many important facts concerning their cultivation, treatment and utilization.

In America, soil surveys have been more extensively made and utilized than anywhere else in the world. It may be of interest, therefore, to describe briefly the American system of soil classification, which has worked very satisfactorily in the United States, and to refer to some of the field methods, and to the value of the work to varied agricultural interests.

The American Method of Soil Classification.—The most important principle of the American system of classification is that it is an economic one, and that soils are defined and classified on the basis of the *characteristics of the soils themselves*, rather than in their relationship to other factors, such as geology, climate, natural vegetation or crops. The unit of classification is the "Soil Type," which is a combination of a "Series Name" and a "Class (Texture) Name" as, for example, "Sassafras Loam" in which "Sassafras" indicates the "Series Name" and "Loam" the "class (texture) name," the two names together representing "the soil type."

The Soil Series.—The determination of the Soil Series is based upon the following soil characteristics :—

- I. Geological Origin of Soil Material.
- II. Mode of Formation.
- III. Topographical Position.
- IV. Drainage.
- V. Profile.

The Soil Class (Texture).—In the United States it is recognized that all soils are made up of the following soil separates :—

Fine Gravel	..	..	..	2 to 1	mm.
Coarse Sand	..	..	..	1 to 0.5	"
Medium Sand	..	..	..	0.5 to 0.2	"
Fine Sand	..	..	..	0.2 to 0.1	"
Very Fine Sand	..	..	..	0.1 to 0.05	"
Silt	..	..	..	0.05 to 0.005	"
Clay	..	..	..	0.005 to 0	"

together with more or less organic matter.

The content of organic matter in soils, except in rare cases, is small, seldom amounting to more than 10 per cent. in agricultural soils and usually much less. Furthermore, if thoroughly decomposed, as in the average soil, it is extremely fine in grain and falls within the clay group of the soil separates. It is evident, therefore, that the texture of most soils depends mainly upon their mineral composition. It is further evident that the heaviness or lightness (texture) of any soil depends upon the relative proportion of the various soil separates of which that soil is composed. Experience has shown that a great range of combinations exists and therefore twenty textural groups are recognized. These groups are as follows :—

- | | |
|---------------------------|----------------------------|
| (1) Coarse Sand. | (9) Coarse Sandy Loam. |
| (2) Sand. | (10) Sandy Loam. |
| (3) Fine Sand. | (11) Fine Sandy Loam. |
| (4) Very Fine Sand. | (12) Very Fine Sandy Loam. |
| (5) Loamy Coarse Sand. | (13) Loam. |
| (6) Loamy Sand. | (14) Silt Loam. |
| (7) Loamy Fine Sand. | (15) Sandy Clay Loam. |
| (8) Loamy Very Fine Sand. | (16) Clay Loam. |

(17) Silty Clay Loam.

(19) Clay.

(18) Sandy Clay.

(20) Silty Clay.

If gravel, stones or shale be present in such quantities as to influence the economic value of the soil type the terms "gravelly," "stony" or "shale" are used in addition to the class name.

In the actual determination of the soil class (texture) in the field only the surface layer (6 in. to 12 in.) receives consideration and the class of the soil type is named accordingly. The other characteristics of the particular soil type under observation are also examined in the field and the type is classified in a definite "Soil Series" according to these characteristics. The series name, together with the class name, designates the "Soil Type."

Making the Soil Map.—In the actual soil mapping in the United States, the field men available in a given area are divided into field parties, two or more men working together in each party. Three men often work together to advantage. Automobiles equipped with special speedometers for the measuring of short distances are used for transportation. The usual procedure is to choose each day a circuit for survey surrounded by roads or lanes, one man remaining with the car and surveying the soils along the roads, the other men walking through the fields also identifying and mapping the soils and joining the car at a previously appointed place. The soil boundaries mapped by the various men are then discussed and joined. Each man is of course equipped with a base map upon which the soil boundaries are placed, or, having no base map, constructs his own with the assistance of a plane table. One man, usually the one having the greatest experience, is placed in charge of all the parties and is responsible for the planning and conduct of all the field work. At the completion of the survey, he is also charged with the preparation, for publication, of the report of the area.

How Soil Types are Determined.—The soil surveyor's tools are a soil auger about 3½ to 4 ft. in length capable of extension 2 or 3 ft. deeper if necessary, a spade and a hand trowel. In ordinary soil surveys, the auger is the implement most used. With this instrument, the surveyor determines the texture of the surface soil and establishes the class of the soil type under examination, together with the other various characteristics of the whole soil section to a depth of 3 ft. or more. He therefore examines the whole of the soil profile with the soil auger. The number of examinations necessary depends

entirely upon the amount of detail encountered in the field, but in no case in detailed mapping are examinations made at a greater distance than a quarter of a mile apart. When all the soils of the selected area are identified and mapped, the report of the area is written.

The Soil Survey Report.—The soil survey report aims to give a very brief description of the area under survey, such as its location, boundaries, size, the general physiography, topography and the drainage of the region. Brief statements are made concerning the character and density of the population; principal towns; transportation facilities by rail, road or water; markets; and climate. The distribution and amount of rainfall; extremes of heat and cold; frosts; and the length of the growing and grazing season are given; and the influence of these climatic factors on the agriculture of the region is stated. Considerable information concerning the present agriculture of the area is also included, such as the history of crops and soil usage, the present status of agriculture, with particulars of the main money crops and principal subsistence crops. Census figures are quoted showing the extent, yield and value of the different crops produced and the number and value of live stock. The adaptations of various crops to the soils of the region are mentioned, together with such facts as methods of cultivation; farm equipment used in the area; rotations practised; fertilizer treatments to pastures and the various crops; the kind, efficiency, wage and abundance of labour available; the average size of farms; and the tenure and money value of land. This information aims to furnish the reader with a clear idea of the general nature of the various agricultural conditions existing within the region.

Most of the report, however, is given to a detailed discussion of the soils, each soil type is named, its colour, depth, texture and profile described, together with a detailed description of the location, topography, drainage, agricultural importance and nature of use, *i.e.*, whether as arable land, permanent or temporary pasture or for forestry. The relative importance of crops grown on each soil type; the average and range of crop yields obtained; how the cultivation of each particular soil type is handled; the kind and amount of fertilizer used on crops; the cash value of each soil type; and such suggestions concerning the improvement of cultural practices as comparative observations may dictate—all these points are also related in detail for each individual soil type.

The completed report therefore furnishes a considerable fund of agricultural and soil information of great value to both practical and scientific interests, and it is the aim of this paper to attempt to point out the value of such soil surveys and to indicate how soil survey reports may be best utilized by all those interested in the various agricultural pursuits.

Value of Soil Surveys to Institutions of Research.—Soil surveys are of inestimable value to agricultural research institutions and especially to those engaged in the solution of crop production and other problems of the soil, from whom advisory information upon these subjects may be expected. Usually, in England and elsewhere, such institutions are charged with the duty of supplying this information in some specific district, such as two or three counties or a large political sub-division. In the United States, each state supports at least one, and sometimes more than one, agricultural experiment station having the same responsibility within its respective state. These institutions are, therefore, greatly interested in their own local problems of crop and soil treatment. It is also generally recognized that different soils respond differently to given crops and given treatment, and it is, therefore, very essential that the extent and identity of the soils under treatment be thoroughly understood. This information the soil survey supplies. The manifold advantage of such basic information can hardly be questioned. By such a system in experimental soil work, all experiments are located on typical soil types with the assurance that results secured are applicable to the same soil under the same climatic conditions, and that conclusions drawn are of the utmost scientific accuracy and practical value. The State Experimental Stations of the State of Iowa are so convinced of the soundness of this system that there have been established throughout the State many soil experiment fields* located upon specific representative soil types as identified and classified by soil surveys. The results from these experimental fields are giving basic comparative information for each soil type, and upon such soil problems as the use of farm manure, the application of lime, the addition of phosphorus either in the form of rock phosphate or super (acid) phosphate, the use of complete commercial fertilizers, and the turning under of crop residues. By such work, the experimental error due to soil variation is reduced to a minimum. The same principle applies in other

* Soil Experiment Fields and their Value. P. E. Brown, Iowa State College. (*Soil Science*, Vol. XIV, No. 5, November, 1922.)

lines of agricultural research in which the soil factor plays a part, and satisfactory, accurate experimental results will only be obtained by an understanding and classification of the soil types concerned. This information the soil survey supplies.

Soil Surveys and the County Organizer, Advisory Chemist and Advisory Specialist.—The task of the county organizer and advisory chemist in any agricultural community is a most difficult one, and each crop-year brings with it additional problems and responsibilities. If the fruit crop of John Smith fails to respond to a certain cultural treatment or method of disease control, or if Will Jones desires to grow a crop of sugar beets and has never before attempted the cultivation of the crop, the adviser is expected to furnish the necessary magic to bring about the desired result. Great advances in agricultural science in the past decade have enabled the adviser to give most helpful advice. In the case of the proposed sugar beet crop, he is able to tell the grower at once the name and variety of the best seed, the kind and amount of fertilizer needed, and complete information concerning the cultural practices known to be successful in the production of the crop. In fact, he has available and actually furnishes very full information upon every condition necessary for successful production except the soil and the weather. Weather conditions are, of course, beyond human control, and add just another speculative element to crop production and the interest of farming practice ; but, concerning the soil, how much more simple the problem would be were the adviser able to designate and, upon examination, point out on the grower's farm the soil best suited to the sugar beet crop, or, in the too frequent absence of a desirable soil type, advise against the proposed planting and suggest other crops which he knows are successfully grown on the soils in question.

With the many duties of the adviser, he is quite unable to make personal detailed soil studies, and for lack of a soil survey the necessary information would not be to hand. Once the soil survey is completed and published, however, a great fund of soil information is at once available, and, with a little study of the report and soil map, the adviser soon finds himself in a position to say to Will Jones that the best soil on his farm for the growing of sugar beet is the "Rexton Sandy Loam" ; further, that there are about 40 acres available, and to obtain maximum results with this soil

the crop requires about 750 pounds of commercial fertilizer to supplement the application of about 15 tons of farmyard manure. He can further advise that there are or are not other soils on the farm worthy of consideration for the production of the crop, and the programme of beet production must be regulated accordingly. Information of such a basic character cannot fail to be appreciated in any agricultural community, and it is only through the availability and utilization of soil survey reports and maps that it becomes available. The expansion of the application of such advice to the production of any crop on available soil types of a county, or even national, area is of inestimable value in the planning of present or future economic production programmes.

The Soil Survey and the Farmer.—The farmer is the ultimate consumer of all economic agricultural information, whether it concerns machinery, animals, crops or the tilling of the soil upon which all his efforts depend. He it is that all agricultural research aims, directly or indirectly, to help. To be successful, soil surveys must be of benefit to the farmer, or their existence can hardly be justified, and the expenditure of public funds in obtaining them would be entirely unwarranted. How then do soil surveys benefit the farmer, and how can he utilize them to his advantage? This at first thought seems a difficult task for, as an individual, he is already nearly overwhelmed with his many practical problems; and it is indeed difficult for him to find time and a place in his overcrowded mind for the new discoveries the science of agriculture has to offer. He does, however, realize that his whole well-being is to a large extent dependent upon the skill with which he cultivates and understands the responsiveness of his soil to his efforts. For years and, sometimes, even for generations, he and his ancestors, consciously or unconsciously, have been close students of the soil, and have learned by experience just when the "clay field" should be ploughed and how the best seed bed is prepared on that "sandy piece"; that the "sandy piece" grows good sugar beet but poor wheat, while on the "clay field" the conditions are reversed. In the little sphere of his own farm, he is an expert on the utilization of his own land, but at a total loss to express himself in *soil terms* universally understood by himself and others. Here the soil survey comes to his assistance. He obtains a soil survey report of the area in which his farm is located, he refers to the soil map and

perhaps with some effort locates his land ; closer observation shows him that the "clay field " really isn't "clay " at all, but Sassafras Loam, and the report also says that this soil grows excellent wheat but a poor quality of sugar beet, just as he knows it does. Reading further he finds that it also gives excellent returns with lucerne or potatoes. Immediately comes the idea—"there on my Sassafras Loam I'll put the lucerne crop I need so badly and have always been afraid to attempt." The educational work is started ; *soil terms* come into use in the community ; the county organizer and advisory specialist, with the use of soil survey maps and reports, are soon able to identify, name and understand the crop adaptations, cultural treatment and economic utilization of the soils of the district.

All the agricultural interests find themselves on common "soil ground," and just as heretofore they have been able to recognize, name and understand the economic value of Jersey cows, white leghorn chickens and alsike clover, they are now able by reference to soil survey maps and reports to identify, recognize and understand the economic value and crop adaptations of soil types. Scarcely more need be said of the value of such information to the individual farmer, once it finds root in the agricultural community. It should be emphasized, however, that it is difficult for the average farmer, personally, to seek and digest soil survey reports, but the duty of conveying the soil facts lies with the county organizer, advisory specialists and other agricultural agencies who must, of course, first acquaint themselves with the use of available soil survey reports and maps.

Soil Surveys and Land Utilization.—Perhaps the broadest and most useful application of the practical value of soil survey reports finds expression in the study of the utilization of lands for agriculture or other purposes. Such studies embrace the present as well as future possibilities of the land, and thus assist in the economic utilization of land already developed and indicate its potential possibilities. All agriculture is, of course, dependent upon the land available for cultivation or other purposes, and a complete understanding of its classification and utilization is essential for success. This applies to the agriculture of an individual farm, a county and even a nation.

As an example of its application to large land areas, the State of New Jersey, U.S.A., is of interest. The boundaries of New Jersey embrace an area of approximately 7,000 square

miles or 4,500,000 acres. The value of agricultural products varying from season to season is between £20,000,000 and £30,000,000. This return comes from a great variety of crops and other agricultural products. Among the crops produced (in 1925) and their approximate acreage the following deserve mention.

Less intensive crops such as maize, wheat, oats and rye occupied approximately 340,000 acres. There were about 412,000 acres of hay made up of timothy, clover and alfalfa (lucerne). Pastures took up 355,000 acres. There were over 5,000,000 fruit trees, mostly apples and peaches; nearly 2,000,000 grape vines; and a total of approximately 200,000 acres of intensive crops, such as white potatoes, sweet potatoes, tomatoes, asparagus and a great variety of other market garden crops. In addition, there were about 122,000 cows and 4,000,000 chickens. Forests occupied about 2,000,000 acres. In this State, the lands are therefore being utilized in a most diversified manner. Further, land values are high and agriculture is becoming rapidly intensified. It is highly essential, therefore, that each soil type be utilized in the most efficient and economic manner. Fortunately, a complete detailed soil survey of the whole of New Jersey is available. This, representing as it does a complete inventory of the soil resources of the State, is assisting in the solution of many agricultural problems.

An analysis of the data made available by the soil surveys shows that, in New Jersey as a whole, there are 2,511,194 acres of well-drained arable soils available, 1,091,510 acres of soils needing drainage and about 717,000 acres of soils not adapted to cultivation and therefore best utilized as permanent pasture or as forest lands. Of the arable lands, it is known and well established that certain crops and crop varieties grown in the State are better adapted to certain soil types than others. For example, the field studies of the soil survey indicate that the best soil for the production of white potatoes is the *Sassafras Loam*, and the State possesses a total of 184,290 acres of this soil type. The acreage of potatoes produced is now only about 70,000 acres, showing that there still remains a potential acreage of about 114,000 acres available for this crop. Should economic conditions warrant the expansion of the potato acreage, therefore, the *Sassafras Loam* would be the soil type strongly recommended for development. The same information is available for wheat and oats, timothy and clover, maize, rye, alfalfa, sweet

potatoes, orchard and small fruits, cranberries and vegetables—in other words, all the crops under cultivation within the State.

Of the lands needing drainage, it is estimated that approximately 200,000 acres of these soil types are of sufficient potential value to warrant the expense of immediate reclamation. The balance of all land of this type in the State, under present economic conditions, is best utilized either as permanent pasture or for forestry. With the study of such complete soil information, this State is putting into effect a sound policy: land utilization and agricultural development are being made possible only through information available in the completed soil survey.

The county organizers, advisory specialists and research workers of the agricultural college and experiment station, and the farmers of New Jersey, are being educated in the application of soil surveys so that they may all be able to identify soil types by name and understand the characteristics, utilization and value of the various soils in the State and on their own farms. This phase of the work naturally takes some time, but it is progressing rapidly and, in the near future, the county organizer and farmer will discuss the value of Sassafras Loam as compared with the Shrewsbury Sandy Loam for the production of a potato or any other crop, just as they now talk over the relative possibilities of Shorthorn and Jersey cattle for the farm herd. In short, the soil survey has enabled all those engaged in agriculture to express themselves in *soil terms*, the lack of which, hitherto, has been a serious handicap to the exchange of helpful ideas gained either by experimentation or practical experience in the cultivation of soil types.

Soil surveys already completed throughout the United States have given soil terms and soil classification a national scope; the completion of additional surveys in other countries makes for international soil understanding. Agricultural conditions of one nation constantly affect others, for present agricultural problems are world-wide; changing economic conditions constantly affect crop production; while shifting markets and increasing competition further complicate matters. As the centres of population increase, extensive methods of production give way to intensive cultivation; new irrigation projects develop and unsuccessful ones fall by the wayside; afforested areas become new arable and pasture lands; there is an over-production of agricultural products; prices fall; unprofitable marginal lands go out of production; erosion

takes its toll and further depletes them; there is a world-wide depression in agriculture; farmers become bankrupt and leave the land.

All this has taken place from time immemorial; it is taking place at the present time. "What is the solution?" we all ask, at the same time realizing the many complicated factors involved. The solution of all our agricultural problems is most difficult, and perhaps sometimes seems impossible. We may at least be sure that the sooner the soils of individual farms, counties and nations are completely surveyed, the sooner we may hope for that world-wide prosperity of agriculture to which every conscientious tiller of the soil is entitled.

* * * * *

THE VARYING EFFECT OF LIME ON GRASS LAND WITH DIFFERENT SCHEMES OF MANURING

WINIFRED E. BRECHLEY, D.Sc., F.L.S.,
Rothamsted Experimental Station.

UNDER modern methods of manuring and treatment of grass land, the question of liming assumes greater importance as time goes on. It is gradually becoming recognized that, whereas much of the grass land in this country is capable of benefiting by the application of lime, there are other areas on which lime may be harmful, reducing the crop instead of increasing it. On the other hand, it has recently become clear that under certain extreme conditions of climate, such as frost and drought, judicious applications of lime may make all the difference between a reasonable crop and none at all. Both these cases are exemplified at the present time by the Rothamsted permanent grass plots on heavy loam, and future developments will be carefully watched.

In an earlier number of this JOURNAL* an account was given of the preliminary results of applying lime to three areas of permanent grass for hay, which had been under definite manurial treatment for a number of years. Broadly speaking, it was found that considerable increase was brought about by liming areas receiving artificial manures containing sulphate of ammonia, but that where organic manure, such as dung, was applied, with or without artificials, the tendency was for liming to decrease the yield. These experiments have been continued, and demonstrate the correctness of the preliminary results.

* September, 1925, pp. 504-512.

At the end of 1919, three plots (A, B, C; see Table I for manuring) were subdivided and given light and heavy dressings of lime, the remaining third being unlimed.*

Owing to the initial variation in the soil acidity, the corresponding dressings on the three plots varied in quantity, but the amounts on the two plots receiving dung were sufficiently alike to admit of a fair comparison of results. Lime has been applied on three occasions, early in 1920, 1924 and 1928, and figures are thus available for two complete liming courses and part of a third.

TABLE I.—MANURING AND LIMING OF PLOTS A, B, C

	<i>Manuring</i>	<i>Light liming</i>	<i>Heavy liming</i>
		lb. per acre.	lb. per acre
		Applied 1920, 1924, 1928	
A (Plot 19) ..	Dung every fourth year (14 tons per acre) ..	570	3,150
B (Plot 20) ..	Dung every fourth year (14 tons per acre), nitrate of soda and mineral man- ures in intervening years (e.g., dung 1905, artificials 1906, 1907, 1908) ..	570	2,772
C (Plot 18) ..	Sulphate of ammonia, po- tash, magnesia and sul- phate of soda every year	3,951	6,788

With Dung Only (Table II, Plot A).—On the first two courses, the application of lime, one year before the dung, had little influence on yield, but, after the organic manure had been put on, the crop from the limed plots fell considerably. At the third application, in 1928, the heavy dressing caused an immediate and considerable drop in yield, possibly indicating a cumulative effect of the earlier treatments, accentuated by the extra supply. The aftermath was reduced with both dressings almost every year, the difference between the two not being very marked. For ease of reference all the crops for each four-year course of liming have been added together and averaged, and in addition, for purposes of comparison, the yields have been calculated as percentages of the crops on the unlimed portion of the plot for each course.

With heavy dressings of lime, the reduction of total crop in each period has been remarkably steady, 83·5, 81·8 and 79·4 per cent. of the unlimed crop being produced in successive periods. With the lighter dressing, the harmful effect seems

* The light dressing was determined by a colorimetric method based on the hydrogen-ion concentration of the soil, the heavy dressing on the Hutchinson-MacLennan method of estimating lime requirement.

TABLE II.—PLOT A

(a) *Average yield of hay, in cwt., per acre per annum*

<i>Liming</i>	Over period 1920-3			1924-7			1928-9		
	1st	2nd	Total	1st	2nd	Total	1st	2nd	Total
None ..	28.0	18.3	46.3	27.3	12.3	39.6	9.7	3.2	12.9
Light ..	23.2	15.5	38.7	25.7	8.8	34.5	10.2	1.8	12.0
Heavy ..	21.5	17.2	38.7	24.3	8.1	32.4	8.4	1.8	10.2

(b) *Crop as above, expressed in percentage of unlimed*

<i>Liming</i>	1st	2nd	Total	1st	2nd	Total	1st	2nd	Total
None ..	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Light ..	82.8	84.6	83.5	94.1	71.2	87.0	105.5	58.3	93.8
Heavy ..	76.6	93.9	83.5	88.8	66.3	81.8	86.7	57.5	79.4

to be wearing off as time goes on, the percentages with lime being 83.5, 87.0 and 93.8 of the unlimed.

With simple organic manuring, the composition of the herbage is not affected to any marked degree. Considerable variations occur from year to year, due to seasonal effects, and the only constant change seems to be a tendency towards reduction of bent grass (*Agrostis*) and sweet vernal grass (*Anthoxanthum*), particularly with heavy liming. One very noticeable feature was the large proportion of meadow pea (*Lathyrus*) after the first two occasions that the lime was put on (Table III), followed by a return to the normal quantity till the next lime application, but as this also occurred on the unlimed portion of the plot it was obviously seasonal and not associated with the effect of liming. The increase did not occur in 1928, after the third application.

TABLE III.—PERCENTAGE OF MEADOW PEA (*Lathyrus pratensis*)

	Unlimed	Light liming	Heavy liming
1919	6.0	6.0	6.0
1920	12.3	17.9	8.3
1921	4.8	2.1	3.4
1922	7.4	5.8	6.9
1923	7.2	9.2	15.5
1924	19.5	17.8	20.5
1925	3.9	3.1	1.3
1926	2.3	1.3	0.9
1927	1.2	1.1	1.0
1928	—	—	1.0

The danger of reduced hay yield, where lime is used in conjunction with organic manure on heavy land under grass, is emphasized by another plot on the same field, which receives dung and fish guano alternately every second year and 2,000 lb. per acre of lime every four years. Here again the hay crop is considerably less where lime is applied, the degree of harm varying with the season.

The reduction of yield due to liming is evident in both first and second crops to a very similar extent, and has amounted

TABLE IV.—YIELDS FROM PLOT RECEIVING DUNG, 1921, 1925, 1929
FISH GUANO, 1919, 1923, 1927
LIME, 1920, 1924, 1928

(a) Average yield of hay, in cwt., per acre per annum									
Over period 1920-3			1924-7			1928-9			
Liming	1st	2nd	1st	2nd	1st	2nd	1st	2nd	Total
Unlimed	Crop	Crop	Total	Crop	Crop	Total	Crop	Crop	Total
Unlimed	43.4	10.2	53.6	43.0	16.4	59.4	17.7	3.8	21.5
Limed ..	35.7	8.2	43.9	38.3	15.5	53.8	15.3	2.7	18.0
(b) Crop as above, expressed in percentage of unlimed									
Unlimed	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Limed ..	82.1	80.4	81.8	89.1	94.5	90.6	86.4	72.7	84.0

to 20 per cent. or more on occasion, being considerably affected by season. In most years the depreciation on the limed area is quite obvious while the crop is standing, especially as regards its relative density.

Combination of Dung with Artificial Manure (Table V, Plot B).

—This combination has a different effect upon the quantity and quality of hay produced compared with dung used alone, when lime is applied in each case. With *light* applications of lime, the initial effect was to improve the colour of the grass and bring about a considerable increase in crop, amounting to 18.4 per cent. over the first four years' course for the first crop yields. After the second application in 1924, the improvement was rather less, 12.9 per cent., and after the third, in 1928, the first crop was lower than on the unlimed portion. The second crops throughout were reduced with light liming, but not enough to wipe out any improvement on the first crop. The reduction after repeated liming suggests that the earlier dressings had brought the soil to such a condition that there was no more possibility of improvement with lime, and to a point where further additions of lime caused harm on account of the organic manures applied, as on the plot (A) receiving dung only. This idea is supported by the effect of the heavy dressings, which at first had little influence on the yield, but which, since the second liming, have reduced both the first and second crops to less than those on the unlimed portions.

TABLE V.—PLOT B

(a) Average yield of hay, in cwt., per acre per annum									
Over period 1920-3			1924-7			1928-9			
Liming	1st	2nd	1st	2nd	1st	2nd	1st	2nd	Total
None ..	Crop	Crop	Total	Crop	Crop	Total	Crop	Crop	Total
None ..	32.1	16.7	48.8	35.7	9.4	45.1	16.3	2.9	19.2
Light ..	37.9	13.4	51.3	40.4	7.2	47.6	15.6	2.0	17.6
Heavy ..	33.5	15.6	49.1	32.6	6.1	38.7	15.0	1.8	16.8
(b) Crop as above, expressed in percentage of unlimed									
None ..	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Light ..	118.4	80.1	105.2	112.9	76.8	105.4	95.7	69.0	91.7
Heavy ..	104.6	93.3	100.8	91.3	64.5	85.7	91.5	62.9	87.1

A comparison of the percentage figures given in Table II (b) and V (b) shows that the adverse effect of liming with organic manures is considerably lessened at first by the presence of artificial manures, but that if liming is repeated at regular intervals this benefit disappears. For instance, at the end of 1923 no reduction of total crop had occurred with heavy liming in conjunction with dung and artificials, against a 16.5 per cent. reduction with dung only. After another four years, however, a drop of 14.3 per cent. had occurred in the former case against 19.2 per cent. in the latter, which represents a considerable levelling up due to the extra application of lime. No further change is yet obvious after the third dressing in 1928, but only two years' figures are yet available.

Where artificials and dung are both used, liming has had no constant influence upon the constitution of the herbage, even where heavy dressings are used. Seasonal changes are rather large, especially in years in which meadow pea (*Lathyrus pratensis*) is plentiful, as then grasses tend to be more drastically reduced than are the miscellaneous plants or weeds.

After the first light application of lime in 1920, the herbage was much improved in quality, chiefly owing to the better all-round growth of the majority of species, rather than to the encouragement of a few plants only. With the subsequent reduction in crop due to repeated liming this initial benefit disappeared.

Artificial Fertilizers containing Nitrogen used without Organic Manure.—In this case (Table VI, Plot C), liming has a totally different effect. On the plot observed, no phosphate was given and the nitrogen was applied as sulphate of ammonia. After the first application of lime, with either dressing, the first crops were heavier than those on the unlimed areas, but this was counterbalanced by lighter second crops, so that at the end of the four-year course no appreciable difference in total crop was obtained (Table VI, a). After a second dressing the improvement in the first crops due to liming became more marked, the heavier dressings giving the better results. At the same time the heavy dressings gave a better second cut, though with the lighter dressings this still tended to be slightly below that on the unlimed area. The net result was the very appreciable increase of 38.0 and 64.2 per cent. with light and heavy liming respectively over the second four-year course (Table VI, b), and there are indications that this improvement will be even greater during the present course, 1928-31, though

this will be partly affected by the unusual seasonal conditions in 1929, discussed later on in this article.

TABLE VI.—PLOT C

		(a) Average yield of hay, in cwt., per acre per annum								
		Over period 1920-3			1924-7			1928-9		
		1st	2nd	Total	1st	2nd	Total	1st	2nd	Total
Liming	Crop	Crop	Crop	Total	Crop	Crop	Total	Crop	Crop	Total
None ..	23.5	21.7	46.2	19.9	15.5	35.4	4.1	2.3	6.4	
Light ..	30.2	12.8	43.0	34.4	14.9	49.3	15.1	2.0	17.1	
Heavy ..	31.2	14.8	46.0	40.0	18.1	58.1	21.3	3.1	24.4	
		(b) Crop as above, expressed as percentage of unlimed								
None ..	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Light ..	128.4	58.8	95.0	173.1	96.3	138.0	362.9	86.8	265.4	
Heavy ..	132.3	68.3	101.6	201.5	116.4	164.2	511.9	135.2	378.6	

On this plot, not receiving any dung, liming has had a marked influence on the composition of the herbage. There has been a steady increase in the proportion of grasses present, with a corresponding drop in the miscellaneous plants or weeds. The increase in grasses is largely due to foxtail (*Alopecurus pratensis*), which always responds to good feeding and liming. Cocksfoot (*Dactylis glomerata*) has increased, and oat grass (*Arrhenatherum avenaceum*) has also become more plentiful with the heavier dressing. At the same time the less desirable grasses, such as bent grass (*Agrostis* spp.) and sweet vernal grass (*Anthoxanthum odoratum*), have decreased in amount, as also has sorrel (*Rumex acetosa*), though the reduction in that case has been very gradual and somewhat slow in becoming evident.

The benefits of liming in this case have been becoming more and more apparent every year. The herbage on the unlimed area has been extremely uneven, tussocky, weedy, with relatively little top growth and a generally dishevelled appearance. Year after year, the limed areas have improved till now they are covered with a well developed, even herbage, with plenty of top as well as bottom grass. In 1929 the difference was most striking, owing to the abnormal seasonal conditions. The winter of 1928-9 was very cold, with exceptional frosts, the mean temperatures for January and February being 4.4° F. and 8.0° F. below the averages for the previous fifty-one years. This was associated with a drought, with less than half the usual amount of rain, only 2.613 in. falling during the first three months of the year, instead of the average (over the previous seventy-eight years) of 6.349 inches. This was followed by further droughts and periods of excessive sunshine right up to September and October respectively, and the first and second hay crops of 1929 suffered accordingly.

After the early frost and drought, the unlimed part of the plots receiving dung and artificials became brown, with practically no new growth, and yielded an almost negligible first crop of 2.68 cwt. per acre, while the limed portions were green and relatively well grown, giving crops of 28.77 and 31.86 cwt. per acre with light and heavy liming respectively.

This strikingly beneficial effect of liming was noticeable during the same season on other plots receiving various combinations of manures, but always where sulphate of ammonia was the source of nitrogen supply.

After the adverse winter conditions, the herbage on the unlimed parts of these plots appeared to be dead, forming a light yellowish-brown mat which stood out in striking contrast to the brownish-green colour on the adjacent limed areas and those receiving no sulphate of ammonia in their manurial scheme. When growth started on the latter areas the winter-killed, unlimed plots did not improve, and they remained brown and almost devoid of new vegetative growth throughout the season. The abnormally dry summer doubtless had much to do with the failure to recover, and must have accentuated the original mischief. In December, 1929, there were evidences of recovery, the degree depending upon the manuring. With sulphate of ammonia alone without lime, the plot was becoming fairly well covered with dark green, grassy tussocks, still surrounded by a good deal of bare ground. Where minerals were associated with ammonium sulphate, very little improvement had taken place, and the plots were still covered with a mat of dead herbage, with a few tussocks of green grass or sorrel in places. One striking feature is the beneficial action of silicate of soda when applied to unlimed areas dressed with heavy doses of ammonium sulphate and minerals. Here the alkali in the silicate of soda seems to have acted like a dressing of lime, and the plot showed very considerable recovery, being almost covered with large tufts of Yorkshire fog (*Holcus lanatus*), with comparatively small areas of bare ground in between.

The application of lime to manurial combinations containing sulphate of ammonia prevented the original winter-killing of the herbage. Under these conditions, the plots remained green, got away well in the spring of 1929 and gave relatively good crops considering the adverse influence of the later droughts. The contrast is well shown in the illustrations taken in June, 1929, before the hay was cut. In Fig. 1 the foreground is unlimed and the distant portions of the plots have received

lime. On the left is shown the comparative uniformity of growth on a plot receiving superphosphate only, and on the right the effect of adding sulphate of ammonia without and with the use of lime, the unlimed area being a dead mat of grass. Fig. 2 is a view down the length of a series of plots receiving sulphate of ammonia and minerals, lime being given to the right hand portion and not to the left, which shows the characteristic stretch of dead herbage with some tussocks of grass which had succeeded in re-establishing themselves.

In Table VII, the yields are given for 1929 and for the average for the preceding ten years for three pairs of plots showing the effect of liming with different manures, with and without sulphate of ammonia in each case (*a*), together with other figures giving the result of using nitrate of soda as a source of nitrogen (*b*), the basal quantity of nitrogen being the same in each case.

TABLE VII

(a) *Yield of hay, cwt. per acre. 1st crops*

	1929				1919-1928			
	With S/A		No S/A		With S/A		No S/A	
	No	Lime	No	Lime	No	Lime	No	Lime
No manure ..	2.77	12.10	6.27	6.86	15.69	19.09	12.21	11.73
Superphos. ..	1.02	24.06	10.18	7.42	19.76	30.13	17.49	14.66
Complete minerals ..	0.91	45.77	15.12	30.94	35.67	51.48	26.16	31.85
Averages for three plots ..	1.57	27.31	10.52	15.07	23.71	33.57	18.62	19.41
Ratio Limed No lime ..	17.39		1.43		1.42		1.04	

(b) *Yields, using sulphate of ammonia and nitrate of soda as source of nitrogen*

	1929				1919-1928			
	With S/A		With N/S		With S/A		With N/S	
	No	Lime	No	Lime	No	Lime	No	Lime
Complete minerals ..	0.91	45.77	39.8	40.3	35.67	51.48	56.93	51.90
Ratio Limed Unlimed ..	50.29		1.01		1.44		0.91	

Comparison of the ratio between the yields from limed and unlimed areas shows that in normal years, represented by the average figures for 1919-28, liming improves the crop considerably where sulphate of ammonia is used, by about 40 per cent. in this case, but in the absence of nitrogenous manuring it has very little definite effect. In the abnormal 1929 season, owing to the killing out of grass by ammonium sulphate, the limed crops were about twelve times the heavier, but in the absence of nitrogen an increase of 40 per cent. only was



FIG. 1. (*Left*) Plot receiving superphosphate only.
 (*Right*) Plot receiving superphosphate and ammonium sulphate.
 The parts of the plots in the background have received dressings of lime every four years, those in the foreground have remained unlimed. Extensive winter killing of herbage in the latter case.



FIG. 2. View down Rothamsted grass plots taken in June, 1929. Left foreground shows unlimed plots receiving ammonium sulphate with various combinations of minerals; right, effect of lime with the same manures.

THE VARYING EFFECT OF LIME ON GRASS LAND WITH DIFFERENT SCHEMES OF MANURING

recorded. Comparing the effect of sulphate of ammonia with nitrate of soda the discrepancy in ratio was still more marked. These figures draw attention to the need of care in the use of sulphate of ammonia as a dressing for grass land, and to the advisability of combining some measure of lime application with this form of nitrogenous manuring, unless it is certain that an adequate lime supply is present in the soil. The trouble was obviously a question of soil conditions and not of excessive nitrogen supply, because (1) the harmful effects were mitigated by dressings of lime and (2) plots receiving the same nitrogen dressings in the form of nitrate of soda were not affected by the winter weather conditions, and gave normal crops where no lime was applied.

The variation in the effect of lime, according to the manurial system adopted, is shown in other cases besides those described above, *i.e.*, its harmful action on yield where organic manures are utilized, and its beneficial effect in the presence of sulphate of ammonia.

On the heavy loam at Rothamsted, unmanured areas cut for hay year after year show no response to liming, the average crops having been practically identical over long periods. With nitrate of soda alone, the result is the same, although in this case liming has only been in force for the past ten years.

TABLE VIII. YIELD NOT AFFECTED BY LIMING
Mean crop in cwt.

		1st Crop 1910-1919	1st Crop 1920-1929	2nd Crop 1920-1928
Plot 3. Unmanured—				
	Not limed ..	9.84	11.43	6.40
	Limed ..	9.45	12.04	5.80
Plot 17. Nitrate of Soda—				
	Not limed ..	22.83	23.09	10.40
	Limed ..	—*	23.38	9.67

* Second crops, 1910-1919, are not included, because the data for that period are incomplete in several respects.

With certain unbalanced mineral dressings, and with combinations of nitrate of soda and minerals, liming has a detrimental effect upon yield.

With a complete mineral dressing, including phosphate and potash in addition to the other salts, liming has proved decidedly beneficial to first crop yield, as is shown in Table IX, with little effect on the second crop.

Where phosphate alone has been supplied as superphosphate (Table X), a big reduction of yield with liming occurred in the period 1910-19, but the depreciation was less in the succeeding

TABLE IX.—AVERAGE YIELD (IN CWT.) OF PLOT 7—MIXED MINERAL MANURES

		1st Crop 1910-1919	1st Crop 1920-1929	2nd Crop 1920-1928
Not limed ..	..	26.3	26.9	14.9
Limed ..	..	31.6	33.1	13.3

period 1920-1929, though it still appeared in both first and second crops. With mixed mineral dressings, from which potash is omitted, lime also decreases yield considerably, but in this case the loss has been consistently great over the whole twenty years under consideration.

Although with nitrate of soda alone, the yield is not affected by liming, and with mixed minerals it is improved, yet if minerals are applied after the land has been dressed with nitrate for some years a marked reduction of yield occurs with liming. Further, if nitrate and minerals are applied together a similar reduction is observed, with either light or heavy dressings of nitrate. This effect shows quite soon, as it is equally evident whether liming was started in 1920 (Plot 14) or 1903 (Plot 16).

TABLE X.—YIELDS ADVERSELY AFFECTED BY LIMING
Mean crop in cwt.

		1st Crop 1910-1919	1st Crop 1920-1929	2nd Crop 1920-1928
Plot 4.	Superphos. -			
	Not limed ..	17.06	17.60	7.98
	Limed ..	11.57	16.46	6.65
Plot 8.	Mins. without potash -			
	Not limed ..	16.75	17.60	10.47
	Limed ..	12.84	14.23	7.79
Plot 15.	Mins. after N/S --			
	Not limed ..	25.02	27.85	13.64
	Limed ..	--	24.21	10.90
Plot 16.	Mins. plus N/S light dressing—			
	Not limed ..	39.12	37.95	13.08
	Limed ..	32.54	35.82	11.61
Plot 14.	Mins. plus N/S heavy dressing —			
	Not limed ..	48.28	50.81	17.37
	Limed ..	—	47.11	12.12

From the above results, it is evident that the application of lime to grass land needs to be undertaken with due consideration of the condition and manurial treatment of the soil. The effect of lime naturally varies with the type of soil as well, but its action is not always beneficial. In conjunction with organic manure, or with such combinations of artificials as nitrate of soda and minerals, liming may cause considerable reduction of yield. On the other hand, on an acid soil, such as one rendered acid by repeated applications of sulphate

of ammonia, lime increases the yield in ordinary circumstances, while under certain abnormal weather conditions, as severe frost and drought, it may induce good growth of grass, whereas in its absence the crop may be practically a failure.

THE WORLD'S POULTRY CONGRESS, 1930

V. E. WILKINS, B.Sc., Ph.D.,

Ministry of Agriculture and Fisheries ; Secretary of the Congress.

THE Fourth World's Poultry Congress, which was opened at the Crystal Palace by H.R.H. the Duke of York on Tuesday, July 22, 1930, and lasted until Wednesday, July 30, was generally agreed to have been a success. The number of countries represented was 61, and the total membership approximately 2,300. Over 80,000 people visited the Congress Exhibition, of whom some 50,000 paid for admission. This attendance, considering the unfavourable weather which prevailed throughout the period, may be regarded as very satisfactory.

The Congress Proceedings.—Taking first the Congress proper, a brief review of the programme may be given. The majority of delegates registered at The Whitehall Rooms, Whitehall Place, London, S.W. 1, on Monday, July 21, receiving their membership badge and Congress literature, including, in addition to the Congress papers, the final programme, the Exhibition programme and catalogue, a guide to London and invitations to various social functions. The same evening, a reception by H.M. Government was held at Lancaster House, St. James's, where members were received by the Rt. Hon. C. Addison, M.D., F.R.C.S., M.P., Minister of Agriculture and Fisheries.

Papers.—The Paper-reading Conferences at the Crystal Palace commenced at 10 a.m. on the morning of Tuesday, July 22, and were continued throughout the Congress period. Each morning, five conference halls were devoted to the use of members for the reading and discussion of papers which dealt with every important aspect of poultry and small live-stock husbandry. In all, 156 papers, prepared by specialists from all parts of the world, were thus presented and discussed. Each of the five conferences had an honorary chairman, two acting chairmen and a secretary. Interpreters were in attendance so that discussions could be carried on in English, French, German, Spanish and Italian. A sixth session, which

met on two mornings, was devoted to the subject of rabbits. Where found necessary, conference halls were equipped with amplifying apparatus for better hearing.

The complete set of papers to be presented was available in printed form before the opening of the Congress. Each paper was printed in English and summarized in English, French, German, Spanish and Italian. The papers for each of the six sessions (including the one for rabbits) were bound in a separate volume. The *résumés* of the papers in English and the other four languages were also separately bound; thus there were in all eleven volumes, each fully indexed. This arrangement did much to simplify the paper-reading programme and to facilitate discussion.

Entertainments.—A comprehensive programme of entertainment was arranged for members of the Congress. On the evening of the opening day, Tuesday, July 22, the British Broadcasting Corporation kindly organized a Military Band Concert at the Crystal Palace, when the B.B.C. Military Band was augmented by 80 performers. On Thursday, July 24, the members were the guests of the British Poultry Industry at a Reception and Conversazione held at the Palace. This function was organized by a Joint Hospitality Committee representing the Poultry Club, the Scientific Poultry Breeders' Association, the National Utility Poultry Society and the Utility Duck Club. There was a reception by the Presidents of these bodies, also a vocal and orchestral concert, and dancing and hospitality. On the evenings of Friday and Saturday, July 25 and 26, an Army and Royal Air Force Pageant was staged in the Crystal Palace Stadium. The salute was taken on the first night by Prince Arthur of Connaught, and on the second by Lord Thomson, Minister for Air.

On Monday, July 28, Sir Thomas Beecham with his opera orchestra, supported by the London contingent of the Handel Choir, numbering 2,500 voices, gave a performance of the "Messiah" in the Central Transept of the Palace. Later in the evening, there was a display of fireworks in the Palace grounds. On Tuesday, July 29, the Corporation of the City of London held a reception and conversazione at the Guildhall, at which the Lord Mayor and Sheriffs were present and received many of the Congress members.

Finally, on the concluding day, Wednesday, July 30, members were entertained in the afternoon, as guests of H.M. Government, at a garden party held at Windsor Castle.

In addition, the official delegates to the Congress, appointed by the respective Governments, were entertained by H.M. Government at a dinner held at the Hotel Victoria, Northumberland Avenue, London, W.C. 2, on Wednesday, July 23.

Tours.—A series of afternoon tours was arranged during the Congress. These tours comprised visits to well-known poultry establishments and to places of scenic and historic interest. In each case, hospitality was provided for those taking part. On Saturday, July 26, two all-day tours were run, one to Cambridge, which included visits to the various Colleges; the other tour took the form of a run through Essex. The tours were well attended; and in the two Saturday tours alone, nearly 600 Congress members participated. Mention may also be made of an early morning visit to Smithfield Market, London, when some 80 Congress members had an opportunity of seeing the methods of the London wholesale poultry trade, and were entertained at breakfast by the London Central Markets Tenants' Association.

Entertainment of Lady Members.—The lady members of the Congress were specially catered for by the Ladies' Sub-Committee, under the chairmanship of the Countess De La Warr. Visits to shops, private art collections, tours of London, etc., were supplemented by receptions given by well-known hostesses both in and near London. Countess De La Warr, Lady Cynthia Mosley, Lady Evelyn Guinness, Miss Haldane, C.H., Lady Solomon, Mrs. Alexander, the Marchioness of Salisbury, Lord and Lady Lee of Fareham and Mr. Gordon Selfridge were among the hosts and hostesses who kindly received parties of women visitors. The women members were also granted temporary honorary membership of the following Clubs: the English-Speaking Union, the Garden Club, the Overseas League and the Sesame Club. The English-Speaking Union and the Women's Institute section of the Forum Club both gave evening receptions. The programme as a whole was greatly appreciated.

The Congress Exhibition.—The two-fold character of the Exhibition—educational and commercial—needs to be emphasized. Of the various countries participating in the Congress, some 25 staged national exhibits which, collectively, occupied the whole of the North Nave of the Crystal Palace. These national exhibits were designed to show the position of the poultry industry in the respective countries, and the means by which its development had been and is being

fostered and promoted. Taken as a whole, the exhibits presented in pictorial form something akin to a bird's eye view of the poultry industry in the leading countries of the world. No pains had been spared by the countries concerned to make these exhibits worthy of the occasion, and many of them were particularly striking and attracted much attention. While poultry was the dominant feature, other aspects of industry were not debarred at these stands. Italy, for instance, presented a display of Italian art and literature, relating to poultry, which included marbles, bronzes and paintings of the seventeenth century; these being staged side by side with exhibits illustrating the latest developments in that country in poultry breeding and research. Other European countries included small sections of peasant art-work, and Austria gave some prominence to native wines.

A few examples will serve to indicate the attractiveness of this section of the exhibition. A popular feature at the United States stand was the section of a large mechanical hen, in which moving parts showed the digestive processes and the rôle played by various nutrients in the formation of eggs. At intervals, by means of a gramophone record, was given a descriptive explanation—purporting to emanate from the hen—of these processes in her internal economy. Another striking item at this stand was a large pendulum clock, each swing of the pendulum proclaiming the production of yet another 1,000 eggs in the United States, a forcible indication of the enormous production in that country. At all these stands, models, diagrams and charts were liberally employed to illustrate national schemes of education in poultry matters, or to show how poultry farming was carried on. For example, the procedure in a Dutch egg auction; the story of Danish co-operative methods; recent developments in educational work in Spain; the vigilance of the Swedish authorities to ensure the quality of the eggs exported; and the model, from Switzerland, of the poultry farm that lies at the highest altitude in the world. Of more spectacular items may be mentioned the immense panoramic relief map of Canada, from which, at intervals, gigantic eggs emerged to open and disclose cages of living poultry; another similar map in the Canadian Provinces exhibit, with moving trains and steamers to illustrate the transport and export of poultry produce; and the model of the Prince of Wales's Canadian ranch, of which an illustration is given in this issue.



Photo - London Pictorial Co.

FIG. 1. The Egg Marketing Demonstration of the Ministry of Agriculture and Fisheries. This formed the central feature of the Marketing Section of the United Kingdom National Exhibit. On the right (not shown in the view) was the Ministry's Poultry Marketing Demonstration and the Marketing Exhibit of the Scottish Board of Agriculture. On the left is seen the Northern Ireland Marketing Exhibit.

THE WORLD'S POULTRY CONGRESS, 1930



FIG. 2. The Irish Free State Exhibit



FIG. 3. A Section of the Exhibit staged by the Canadian Provinces.

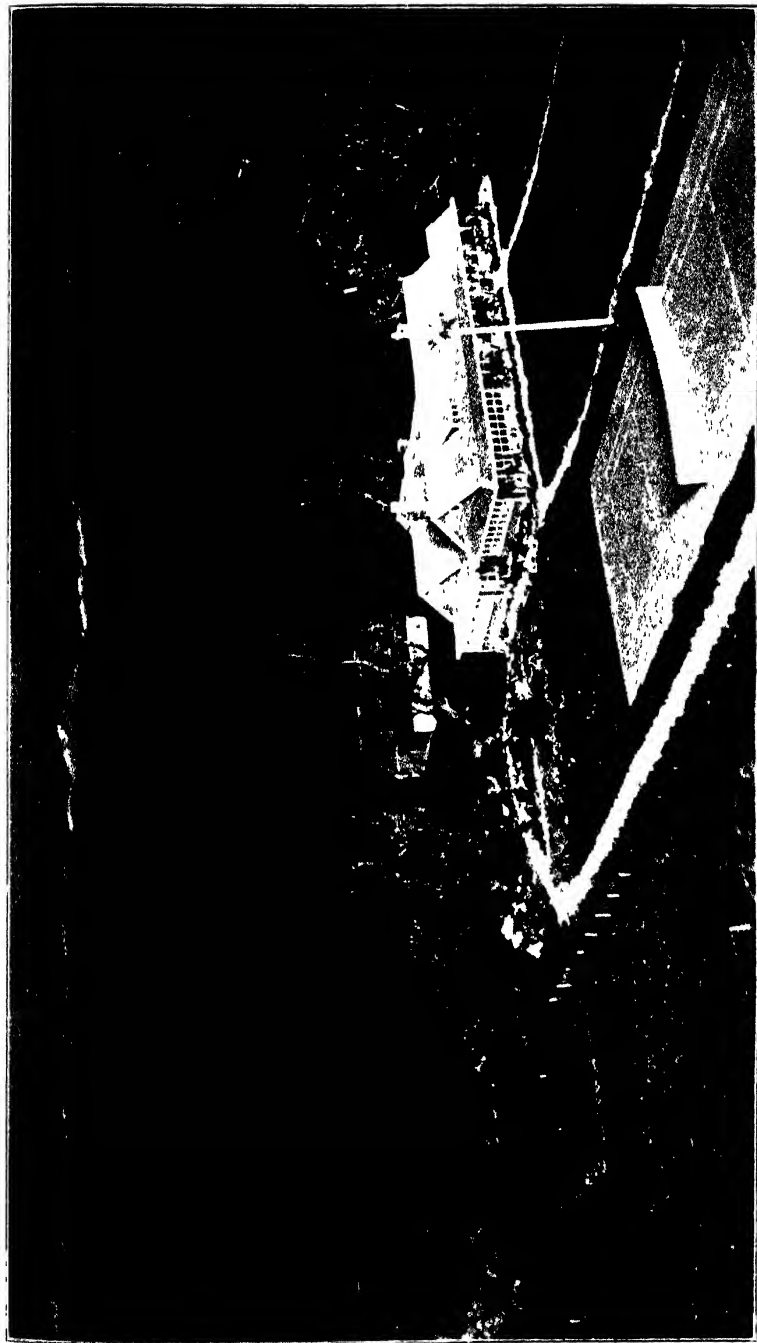


FIG. 4. A feature in the Canadian Exhibit. Model of a corner of the Prince of Wales's (R.P.) Canadian Run I, showing the residence with an impression of the roofline of the Canadian. (R. 100)



FIG. 5. The Pavilion of the Empire Marketing Board in the Central Transpt of the Crystal Palace and Wiles, Scotland, and Northern Ireland collaborated in demonstrating the great influence of

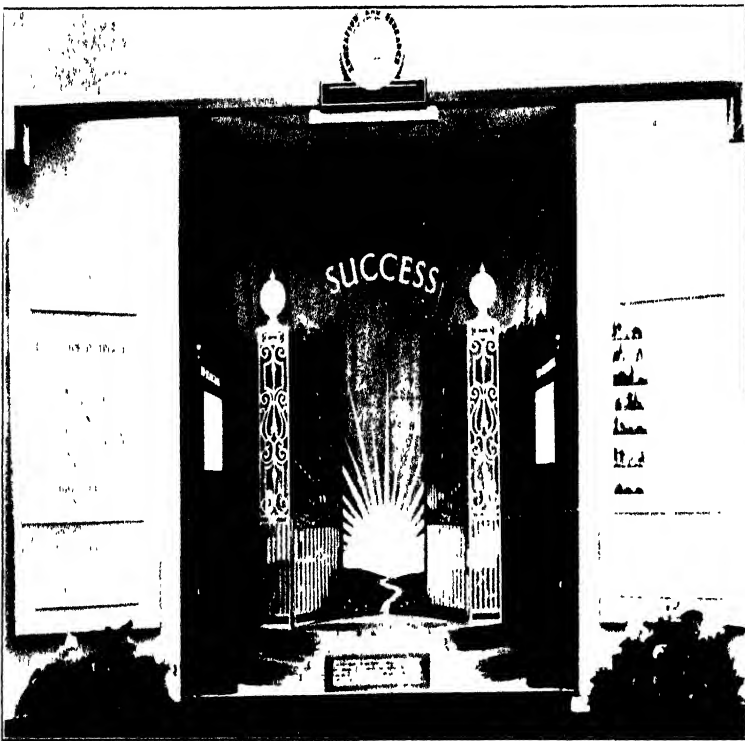


FIG. 6. "Success," the striking symbolical tableau in the centre of the Education and Research Section of the United Kingdom National Exhibit. (See p. 677)



centre is the United Kingdom Exhibit in which the Departments of Agriculture for Finland
on and research on the development of the poultry and small livestock industries. (See p. 677.)



Photos, London Photomac Co.

FIG. 7. A view of the National Exhibits—General view looking up the Main Nave from the
Central Transept.

POLAND

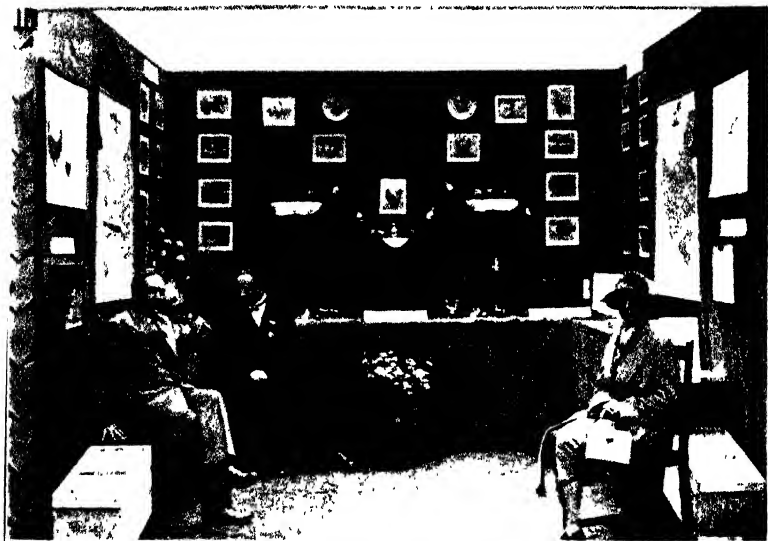


FIG. 8. - The Polish National Exhibit.



Photos: London Panoramie Co.

FIG. 9. - The Belgian National Exhibit.

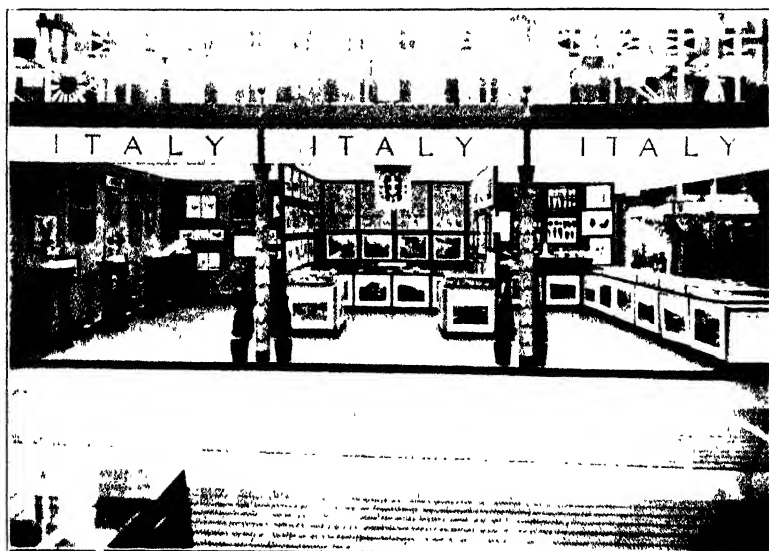
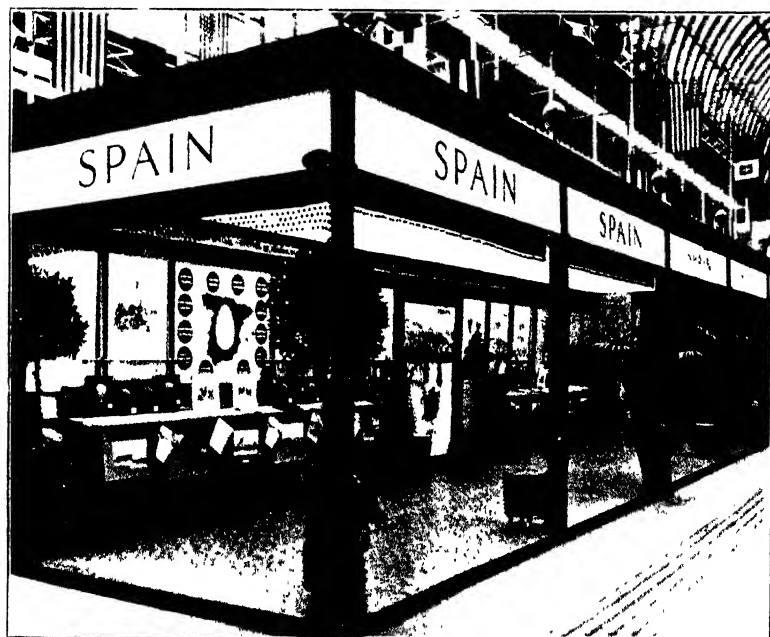


FIG. 10. The Italian National Exhibit

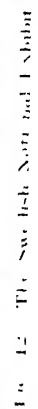


Photos - London Photographic Co.

FIG. 11. The Spanish National Exhibit



THE HOUSE OF COMMONS

[illegible]

The United Kingdom National Exhibit.—The United Kingdom exhibit was divided into two main parts. Housed in the stately pavilion of the Empire Marketing Board, which occupied the whole of one half of the Centre Transept of the Palace, was a special section illustrating the educational and research work in poultry husbandry that is being carried on in England and Wales, Scotland and Northern Ireland. The work of the research institutes, agricultural colleges, county advisory officers, etc., was portrayed in graphic form. The central tableau in this section—"The Gate of Success"—is shown in one of the accompanying illustrations. In this section, the rabbit industry was allotted a prominent place, and fur and wool garments, of all-British production, were effectively displayed by mannequins.

The other section of the United Kingdom exhibit, devoted entirely to marketing, was situated at the extreme end of the North Nave of the Palace. The central feature here was the stand of the Ministry of Agriculture and Fisheries, displaying the National Mark Scheme for eggs and poultry in England and Wales, the candling, grading and packing of national mark eggs being demonstrated on the centre stand, while on a stand to the right, the plucking (by machine), shaping, cooling and packing of table poultry was shown in operation. The apparatus used on the latter stand was described and illustrated in the last issue of this JOURNAL (September, 1930, pp. 599, 600). On a second stand to the right, the Department of Agriculture for Scotland depicted the procedure of the National Mark scheme in that country. Opposite, on the left of the centre stand, the Ministry of Agriculture for Northern Ireland presented, on a large stand, a very effective display illustrating the measures adopted in that country for improving the marketing of eggs and poultry.

The Commercial Exhibits.—Almost all the remaining available space in the main hall of the Palace was taken up by the commercial section of the Exhibition, which occupied the floor and most of the gallery of the South Nave. In this section, the greatest activity prevailed throughout the Congress; any misgivings that may have been entertained by trade exhibitors in the early days of preparation were quickly dissipated when the exhibition opened, and the various firms were unanimous in their appreciation of the opportunities afforded for doing business. Approximately, 50,000 square feet of floor space were devoted to trade exhibits,

these including everything of interest to the poultry industry, from the smallest items of equipment to electrically-operated incubators with a capacity of nearly three tons of eggs. Here were to be seen the latest developments in battery brooders, also electrically-operated, where day-old chicks from incubators start life on the "ground floor," proceeding upstairs as their size and weight increases, and only vacating the battery when ready for the table. Here also were shown machines that sorted eggs according to weight, candling, stamping and, finally, packing them for transport; machines that preserved eggs for a year; poultry houses and appliances of every description; and a great variety of foodstuffs—in short, every material requirement that the poultry keeper could possibly need in his business.

The Display of Livestock.—The livestock display, housed on the lower floor (Terrace level) of the Palace, in a portion of the main gallery, and in outside marquees, comprised a collection of some 7,000 head of the world's best stock in fowls, ducks, geese, turkeys, pigeons and rabbits, including breeds from the Argentine, Canada, the United States, Newfoundland, all the European states, and from countries ranging across Asia to the Eastern Archipelago. Practically every poultry breed of importance was represented; spotted geese, Roman geese, turkeys from their native habitats, runner ducks from the Netherlands East Indies, distinctive guinea fowl from Italy, white-legged, bare-necked and crested fowls from Central Europe, old English game birds, etc. Some of the—to English eyes—more exotic of these breeds were illustrated in this JOURNAL last month (September, 1930, p. 532). The main attraction of the display, however, centred in the modern breeds, shown on a scale never before attempted in this or any other country. The British entries in this section included, as one of the most important features, many of the birds which have obtained high records for egg production in the numerous trials officially recognized in this country.

In connexion with the livestock display, every effort was made to facilitate business. Sales bureaux, with interpreters in attendance, were provided in the main poultry section, and in the annexe allotted to pigeons and rabbits. In addition, an auction sale of stock, not previously sold, was held on the third day of the Congress.

Staging of the Exhibition.—No note on the Exhibition, however brief, would be complete without some reference to its general layout and staging. Uniformity in the design of

the stands was made a cardinal condition ; thus the excellent tradition of homogeneity, inculcated by the British Empire Exhibition, and by modern exhibitions on the Continent, was maintained. As a harmonizing note with the grey paint of the Palace ironwork, a colour scheme of primrose yellow was adopted for the stands, relieved by herringbone flecking and stencilled motifs of poultry, rabbits, etc., in black. This colour note was heightened by gilded pear-shaped finials and by fascia boards in white with a good classic type of lettering in black. The design of the stands was the work of Mr. J. Stevens Lee, A.R.I.B.A., Superintending Architect of the Ministry of Agriculture and Fisheries, and their appearance evoked much favourable comment from both the press and the public. The attractiveness of this lay-out was further enhanced by a decorative scheme of flags, banners and plants, carried out by H.M. Office of Works under the supervision of Mr. J. Hooper, of that Department, which was also responsible for the excellent fitting up of the various conference halls, the Congress Club, etc. The decorative side of the Exhibition was also supplemented by special floral displays staged by leading horticultural firms.

Conclusion.—It is almost needless to say that the holding of a world congress, such as this, is only made possible by the loyal co-operation and unstinted efforts of large numbers of devoted workers. To them, the world over, the hearty thanks of the promoters are due. For the organization, in particular, of the United Kingdom contribution, acknowledgment must be made of the valuable services rendered by the various committees dealing with special sides of the work ; of the whole-hearted efforts of the county poultry instructors working in their respective areas ; and of the active interest and support given by the Council and Branches of the National Farmers' Union, and by the specialist poultry societies. The enthusiasm which characterized the preparations in this country was derived in no small measure from the example set by the Congress Presidents—Dr. Addison, M.P., the Minister of Agriculture and Fisheries, Sir Edward Archdale, the Minister of Agriculture for Northern Ireland, and Mr. W. Adamson, M.P., the Secretary of State for Scotland—and by Mr. F. C. Elford, of Canada, First Vice-President of the Congress and President of the World's Poultry Science Association. To Mr. Elford and to his co-adjutor, Sir Edward Brown, Hon. Past-President of the Poultry Science Association,

the Congress paid a graceful and merited tribute of appreciation. Last, but not least, to the Press, and particularly the specialist Poultry Press, are due the very cordial thanks of all concerned with the organization for the publicity given to the preparation and proceedings of the Congress and for the world-wide interest evoked thereby.

Of the success of a congress organized by this country, it is more fitting, perhaps, that the nation's guests should testify. The feeling of our visitors in this matter is sufficiently indicated by two of the various resolutions passed at the final meeting of the Congress on July 30. The first, addressed to His Majesty the King, reads as follows :—

May it please Your Majesty :

We, the Delegates and Members of the Fourth World's Poultry Congress, meeting in the Final Assembly, beg respectfully to present to Your Majesty our heartfelt appreciation of the manner in which your Government and Departments of State have organized this Congress and Exhibition, and for the unbounded hospitality accorded to us in the capital of your great Empire over which we hope you may long be spared to reign.

Representing as we do sixty-one countries, we shall carry to our homes memories which can never be effaced of the most remarkable assembly ever held in connexion with any branch of Agriculture. It cannot fail to help in binding the Nations together and exert a potent influence in the days to come.

The other resolution, with which this brief review of the Congress may very fitly conclude, records that :—

We, the Delegates and Members of the Fourth World's Poultry Congress, desire to convey to the Governments of Great Britain and Northern Ireland, and particularly to the Ministry of Agriculture and Fisheries, our deep indebtedness for the boundless welcome accorded to us, and our admiration of the organization of the Congress and Exhibition, the success of which, we are confident, will fully justify their having undertaken the responsibility for their great enterprise. Our assurance is that it will promote the prosperity of the British Poultry Industry and that its influence will be felt throughout the entire world.

OBSERVATIONS ON NEMATODE PARASITES OF SHEEP IN EAST SUSSEX

R. H. B. JESSE, B.Sc., N.D.A.,
Director of Agriculture for East Sussex.

THERE are in East Sussex nearly 200,000 sheep, the density of the sheep population being approximately 525 per thousand acres. The distribution of sheep is not, however, uniform in the county, being more dense in the extreme east or Romney Marsh district and along parts of the South Downs.

Two widely differing breeds of sheep are found in the county—the Southdowns and the Romney Marsh. The Southdown is typically a breed of arable districts, whilst the Romney Marsh, or Kent, is pre-eminently a grassland sheep.

The elevation at which most Southdown flocks are kept ranges from 300 to 700 ft. above sea level; on the other hand, much of the sheep-grazing land of Romney Marsh is only a little above sea level. Again, the methods of grazing differ between the Southdown and the Romney Marsh breeds; the Southdowns, even when not folded, tend to cling together and graze in close proximity; the Romney Marsh sheep, on the other hand, usually scatter and are more individualistic in their habits.

Despite these wide differences, nematode parasites, or thread worms, are the cause of very heavy losses in both breeds. It must not be assumed that they are more prevalent in East Sussex than in other counties; probably the reverse, but possibly more attention has been given to their prevalence than in many other districts.

In addition to wide differences in type and habit of the two breeds, together with the varying elevations of the sheep districts, the methods of sheep farming are distinctly different. The typical Southdown flock is folded during the night on arable crops; usually, during the day, it runs on the hills or, towards lambing time, on lower-lying fields at the foot of the Downs. The Romney Marsh sheep, on the other hand, generally spends all its life on grass land. Despite these differences, nematode parasites are common to both. It is probable, however, that the losses due to these parasites, if abundant, are greatest amongst Southdowns, although the Southdown system of farming tends usually to keep the parasites in control. The arable cropping on a Southdown farm as a rule is not of an intensive character; the soils are often poor and thin, and sheep are rarely folded over the same land twice in a year. This practice has been instrumental in

giving the Southdown such an enviable reputation for health. Latterly, there has been a greater tendency to reduce the acreage of arable crops grown for Southdown sheep and to allow them a greater run on enclosed pasture and hill land. In certain instances this, or some other factor, has been responsible for an increase in parasitic diseases.

As already pointed out, the Romney Marsh sheep is practically never folded. The fertile tracts of soils in the extreme east of the county are amongst the most heavily stocked land in the country, and but for the practice, which has existed for generations, of removing the lambs, towards the end of August and September, from the Marshes to higher land in the Weald, where sheep are not usually kept, it is probable that thread worms would make sheep farming impossible.

An article in this JOURNAL* sets out very clearly the life-history of two worm parasites of sheep. As is well known to biologists, the classification of that group of organisms known as "worms" is somewhat arbitrary, and the life-history of the different parasites classed as "worms" are not very well understood by farmers. The control of these parasites, however, can only be carried out effectively when their life-history is understood.

Briefly, worm parasites may be divided into two groups, that of the flat worm type and that of the thread or round worm type. To the former belong the ordinary tape worm of sheep and the Liver Fluke. The life-history of the tape worm is still uncertain, but that of the Liver Fluke has been very fully worked out. The losses occasioned by the Liver Fluke are appreciated by sheep farmers, but in the writer's opinion far greater losses are occasioned by the round or thread worms than ever by Liver Fluke—at any rate in East Sussex. It is true that the losses may not be always so spectacular, but there is no doubt that they are far more widely distributed and far more frequently recurrent than in the case of Liver Fluke. It is also certain that they have a wider distribution as regards elevation than is the case with the Liver Fluke.

In the county of East Sussex, their distribution ranges from sea level to nearly 900 ft. above it, and there is no evidence to show that these nematode parasites cannot thrive as well at higher elevations as at the lower levels. In some of the cases investigated by the writer, no evidence could be found of the infested sheep having gone to a lower elevation than

* E. L. Taylor: "Stomach Worms in Sheep": April, 1929, p. 31.

several hundred feet above sea level. Again, these nematode parasites are far less dependent on climatic conditions than is Liver Fluke. Large-scale outbreaks of the latter coincide with wet seasons; outbreaks of thread worms may be just as active in dry as in wet seasons.

The article in this JOURNAL, already mentioned, describes two well-known thread worms—*Haemonchus contortus* and *Ostertagia circumcincta*, known as the “twisted wireworm” and the “lesser” stomach worm of sheep. *Haemonchus contortus* is widely distributed; indeed, it is rare to examine the fourth stomach of sheep without finding some of the parasites present. Their numbers vary enormously, and it would seem that sheep suffer but little when the parasites are few in number, but it is not uncommon to find the fourth stomach teeming with both males and females of the “twisted wireworm”—and then heavy losses inevitably occur. Farmers and shepherds are not always aware of their presence and, even when sheep are badly infested, they may escape observation unless they are suspected. When the fourth stomach of a sheep which has died is examined, they may escape observation owing to discoloration by the chocolate-brown fluid of the fourth stomach. It is, however, more easy to detect them if the stomach is examined shortly after the sheep dies or is killed.

If a small quantity of the contents of the fourth stomach is placed in a tumbler or a glass cylinder, water being added, the worms gradually drop to the bottom. By decantation, most of the colouring matter and sediment can be removed and, in the clear liquid, the thread worms can be easily seen.

The persistency of these parasites is remarkable. In one instance a lamb which had been buried for two or three days was dug up and examined; both male and female “twisted wireworms” were still found to be alive. Even after they had been removed from the fourth stomach and kept for some little time, they were alive and active.

In East Sussex, another thread worm, known as *Chabertia ovina* (formerly *Sclerostomum hypostomum*) is found. Although fairly widely distributed, it is not so commonly found as the “twisted wireworm.” Unlike the latter, the head appears to be blunt and enlarged; it is somewhat shorter but thicker than the “twisted wireworm,” and is generally considered to be innocuous: indeed, Ransom states: “This species appears to be comparatively harmless.” Its habitat is in the intestines and not the fourth stomach. It is true that in

outbreaks of parasitic diseases, amongst flocks in East Sussex examined by the writer, it is rare to find affected sheep where the "twisted wireworm" is absent; but, in a number of affected sheep examined, they were in such small numbers that whether they were solely responsible for the serious losses seems questionable. On the other hand, *Chabertia ovina*, for which there is no popular name, was most abundant.

The photographs accompanying this article demonstrate that, if the life-history of these nematode parasites is understood, and if affected sheep are subjected to treatment which breaks the life cycle of the parasite, then in the majority of cases the sheep recover and will produce healthy lambs.

The ewes in Fig. 1 were taken from a Southdown hill farm situated several hundred feet above sea level, and no evidence was forthcoming that the sheep had been on wet, low-lying land. For some years, there had been heavy losses amongst the lambs and also considerable mortality amongst the ewes. During the early part of 1928, the flock, despite good feeding and constant drenching with medicines, was in a deplorable condition, although the majority of the ewes were not in quite the emaciated condition of those shown in the photograph. Those shown in the photograph were picked out as being the worst in the flock and certain to die if kept on the farm.

The most obvious symptom of sheep severely attacked by these parasites is extreme emaciation; as will be noticed the backbones protrude, in fact the bones show all over the body; in some cases scouring is noticeable, but emaciation may be present without much scouring. There is also a characteristic appearance of the head, which seems to be too large for the body, and dropsical swellings appear beneath the jaws, whilst in practically all cases after death or when the sheep are killed there is an abnormal quantity of body fluid present.

The ewes were removed to the Agricultural Institute Farm at Plumpton and immediately began to make excellent recovery. This recovery was due neither to medicinal treatment nor to artificial feeding, but was attributable to the simple fact that the ewes were put on fresh land free from parasites. Sheep examined from the farm, from which the ewes were taken, were known to be infested with *Haemonchus contortus* and very heavily with *Chabertia ovina*.

The second photograph was taken in December, 1928, and it will be seen that remarkable progress had been made. The ewes were mated and, subsequently, one was killed and examined, but parasites were not found. The third photograph,



FIG. 1. Photograph, taken July 18, 1928, of ewes removed from a flock known to be infected with *Haemonchus contortus* and *Cyathostomum*.

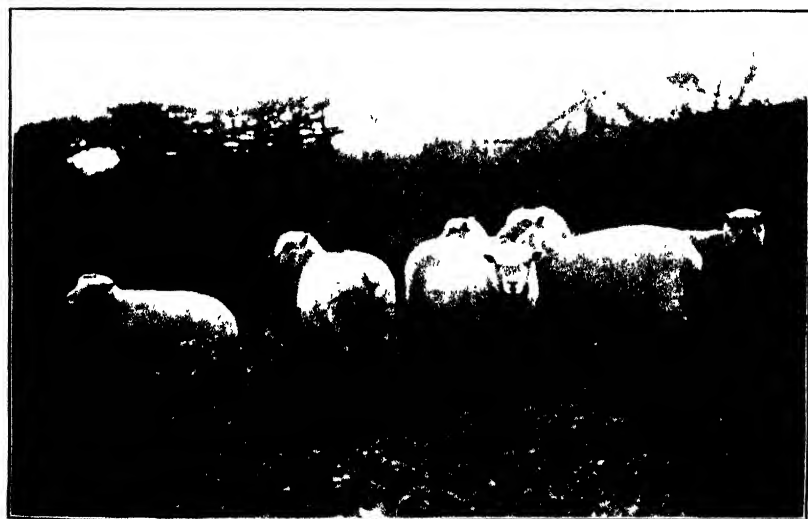


FIG. 2. Photograph of same ewes, as above, taken December 14, 1928.

OBSERVATIONS OF NEMATODE PARASITES OF SHEEP IN EAST SUSSEX



FIG. 3 Photograph of ewes and lambs taken May 10, 1929.



FIG. 4.--Photograph of ewes and lambs, taken July 16, 1929.

taken in May, 1929, shows that the five ewes had produced six strong, healthy lambs. The ewes still received no concentrated food and by this time they were fat, as, also, were the lambs.

A further photograph was taken in July, 1929 (Fig 4), just after the ewes had been shorn. It seems almost incredible that such complete recovery should have been made from their emaciated condition of twelve months previously, but not only were the ewes then fat and fit for the butcher, but the lambs, which were born late, are seen to be as fat and nearly as big as the ewes.

This demonstration was intended to emphasize the fact that, with thread worms, a period of some ten days elapses after the passage of the eggs from the host before the infective stage is reached, and that if this is realized and acted upon the parasites may be controlled or eliminated from a flock. If sheep could be infected again by the eggs immediately they dropped from the host it would be practically impossible to cope with the parasites. Further, if it were possible for the parasites to complete the life cycle within the host, recovery would be impossible.

It should be very clearly understood, however, that although such a remarkable recovery occurred with the ewes removed from this heavily infested flock, similar results would only temporarily be obtained by removing a large flock on to fresh land unless the sheep were moved to fresh fields at short intervals so that neither ewes nor lambs could pick up the parasites when in the infective state. Further, it should be remembered that such land, after the passage of the flock, would be liable to cause parasitic trouble in sheep subsequently passing over it.

Since the last photograph was taken, one of the lambs born has been examined. No trace of parasites or of eggs could be found.

The flock, from which the ewes were taken in 1928, was kept away from the hill grass land on which it had been running previously, and both ewes and lambs were kept entirely on arable land. Even on this heavily infected farm, the majority of the ewes made complete, if not such spectacular, recovery as in the case of those shown in the photographs.

The writer is much indebted to both the owner of the flock in question and his agent who, in the interests of other flock masters, placed not only their knowledge and information but also the flock at his disposal for experimental and demonstration work.

The following summary of the condition of the flock prior to 1928 has been kindly supplied by the owner's agent :—

The year 1926 was considered to be the worst year with the lambs, when it was estimated that the loss was approximately 40 per cent. of the total. Out of some 200 lambs, only 42 could be sold at the local fairs, the customary selling places of Southdown lambs. These were the pick of the flock and were sold for 35s.6d. each. The remainder were retained and sold out in small lots during the winter ; the highest figure obtained was 40s.

During the following spring (1927) approximately 220 lambs were born and these at birth were healthy and strong. They were weaned in June, but as in the previous year began to fall away soon after weaning. During this year, 135 lambs were sold at the local sheep fairs and averaged only 35s. each. The majority were poor, although they had been drenched several times. Some 40 ewe lambs were kept back for the flock, together with about two dozen small ones. The ewes did not do well that year and many were in poor condition during the summer. The whole flock, both ewes and lambs, were drenched several times ; indeed, they had as much drenching as was considered safe, yet despite this, apart from lambs, some 20 ewes died.

In the autumn of 1927, 210 ewes were picked out for breeding. As usual, these ewes had improved in condition considerably during the latter part of the summer and early autumn. The following spring, 220 lambs were born, of which about 20 died, some losses being possibly attributable to bad weather at lambing-time. The lambs again did badly and, if anything, were in worse condition than in the previous year. The owner was only able to sell at the local fairs 111 lambs, which averaged approximately 30s. each. Some 40 ewe lambs were again kept together with a number of small ones that were so poor as to be unsaleable, whilst some 20 lambs died during the summer.

It was during the spring of 1928 that the writer first inspected the flock, and as the agent for the owner wrote—“ You well know the wretched condition they were then in ; we had many losses that year and quite 30 ewes died.”

At this point, however, it was decided, despite the expense which would be involved, to keep the flock away from the hill pastures. The lambs when sold the following year, 1929, then averaged at the sales 56s. each, which, as the owner's agent pointed out, was “ a vast difference to prices previously obtained.”

The agent's statement (taken from a letter to the writer) —“For three years we drenched continually and *with little effect*”—is full of significance. Continuing, he says: “Although I have only given you the losses, I have on two or three occasions sold a number of ewes for only a few shillings per head as their condition seemed hopeless, since they were a disgrace to be seen and only helped to pile on the losses . . . The ewes usually picked up in condition during the autumn and fell away again in the early summer. We always had a good supply of green food for the sheep all the year round and also fed liberally on dry food during the winter months, but this made no difference when the summer months arrived. They were in as bad condition in 1927 as in 1928 when you saw them.”

Conclusion.—The prices obtained from the sales of the ewes and lambs shown in the photographs when sold are of especial interest.

(1)	3 ewes sold at 65s. each	=	£9 15 0
(2)	2 „ „ 56s. „	=	5 12 0
(3)	3 lambs sold at 72s. 6d. „	=	10 17 6
(4)	2 „ „ 70s. „	=	7 0 0
			<hr/>
			£33 4 6

The sum realized for the three ewes was higher than the price for any ewes sold in Lewes Market since the Christmas Fat Stock Show, 1928, whilst the price for the lambs, 72s. 6d., was the highest price for lambs sold on that day. When the condition of the emaciated ewes (Fig. 1) is considered, the enormous economic losses due to nematode parasites may, to some extent, be realized.

THE FEEDING VALUE OF ROOTS, HAY AND STRAW

H. CECIL PAWSON,

*Agricultural Department, Armstrong College,
Newcastle-upon-Tyne.*

WHILE the composition and feeding value of the concentrated foodstuffs commonly purchased by farmers has been widely discussed, less attention, generally speaking, has been paid to the part played by the bulky, home-grown foods—roots, hay and straw—included in live stock rations. Yet an examination into the food constituents supplied by most feeding rations will show that by far the larger proportion of such constituents is derived from foods produced on the farm. As an instance may be cited the following commencing ration, recommended by one of the agricultural colleges last winter for fattening cattle, and calculated to give $1\frac{1}{2}$ lb. daily live weight increase:—

	<i>Protein content</i>	<i>Starch equivalent</i>
80 lb. swedes	0.88	5.84
6 „ hay (seeds)	0.37	1.44
straw <i>ad lib.</i> (say, 7 lb.) ..	0.07	1.19
2 „ oats	0.16	1.20
$1\frac{1}{2}$ „ barley	0.10	1.06
$\frac{1}{2}$ „ ground nut cake (decort.) ..	0.21	0.36
	<hr/> 1.79	<hr/> 11.09

In the above ration it will be seen that the bulky home-grown foods supply 1.32 lb. of the total 1.79 lb. protein fed, and 8.47 lb. starch equivalent of the total 11.09 lb. It is only fair to state that the ration quoted was framed with the object of making use of the maximum amount of home-grown foods, hence the small proportion of ground nut cake included. Even where the quantity of purchased concentrates included in a ration is much larger than that given above, it is still true to say that the proportion of food constituents supplied by the home-grown foods is greater than is generally realized.

The significance of this fact lies in the variation which occurs in the feeding value of these home-grown foods, a variation that is much wider in range, and more difficult to allow for, than any occurring in purchased concentrates. In this connexion, the term “feeding value” may be regarded as embracing dry matter content, composition in terms of food constituents, digestibility and palatability.

Roots.—The composition of swedes and turnips, the most widely-grown root crops, is varied by several factors. Through-

out the trials, conducted for over twenty years at Cockle Park, the Northumberland County Experimental Station, the average percentages of dry matter content were, approximately, as follows :—Swedes, 12 per cent., turnips, 9·6 per cent., soft turnips, 8·25 per cent. This means that 20 cwt. of swedes, 25 cwt. of turnips and 29 cwt. of soft turnips contain the same weight of dry food material ; and the results of many feeding tests carried out at Cockle Park show that, for cattle and sheep feeding, the dry matter of swedes and turnips has practically the same feeding value. This conclusion applies to different varieties of swedes and turnips.

It will be noted that this classification of the root crops into swedes, turnips and soft turnips is a modification of that sometimes adopted by seedsmen. The reason for this is that, in the trials mentioned, the three yellow turnips, Early Sheepfold, Selected Fosterton and Centenary, although possessing yellow flesh of the same kind as ordinary turnips, were found to produce a dry matter content so low as to make it necessary to place them, on a food value basis, in the same group as soft turnips. Some farmers have grown these and similar varieties under the impression that they would secure the same feeding value, ton for ton, as ordinary turnips. Hence, it is more accurate to adopt this modified classification, under which the group called soft turnips includes some yellows as well as the whites.

According to Sanders, the starch equivalent per 100 lb. of swedes may range between 5·1 and 7·3 on the basis determined by the late T. B. Wood, viz., that the starch equivalent of swedes is, approximately, 63 per cent. of the dry matter content. Examples cited by Sanders, from which the range of variation is calculated, were :—Swedes grown in Norfolk, 9·4 per cent. dry matter ; swedes grown in the Fens, 8·1 per cent. dry matter ; and Kellner's figure for German swedes, 11·5 per cent. dry matter. The dry matter content, however, varies not only with the district in which the roots are grown, but is affected by local influences of season and soil. For example, at Cockle Park, in 1904, the average dry matter content of the swedes grown was 14·96 per cent., whereas in 1921 the figure was 10·24 per cent. This meant that 20 cwt. of swedes in 1904 had as much dry food material as 29½ cwt. in 1921. In terms of starch equivalent, 50 lb. of swedes from the 1904 crop supplied 4·71 lb. S.E., whereas only 3·22 lb. S.E. was obtained from the same quantity of swedes in the 1921 crop.

The dry matter content of the root crop is also influenced by

the variety or varieties grown. In 1929, in the trials at Cockle Park, varieties of swedes showed a range in dry matter content of 2.43 to 3.17 per cent., and turnips of 1.57 to 2.26 per cent., although grown under the same conditions of climate, soil and manurial treatment. It is generally assumed that generous manurial treatment, especially with phosphates, has a beneficial effect upon the feeding value of roots, although there is room for more exact investigation of this matter.

Straw.—The composition and nutritive value of oat straw, which is chiefly used for feeding, varies with the district in which it is produced and, more particularly, with the stage of maturity at which it is cut. In addition, the variety of oat is not without significance in assessing the value of the straw for feeding, especially in relation to its palatability and digestibility. With cattle on a ration of oat straw and turnips, the better feeding results obtained in the north, as compared with the south of the kingdom, is well known in practice; and this, in large measure, is due to the marked superiority of north-country straw in protein content.

In investigations carried out some years ago, by Collins and Thomas, on the sugars and albuminoids of oat straw, the variation for the sugar in the samples examined ranged from 0.33 to 9.74 per cent., while for the albuminoids the range was from 1.12 to 8.05 per cent.—variations great enough to explain wide differences in feeding value. Manurial treatment, district and harvest conditions, according to these investigators, were the more important influences, although their general impression, resulting from these experiments, was that "good husbandry" often accounted for feeding with oat straw and swedes being more successful in some districts than others. In this connexion, the maturity of the crop when harvested is of vital importance, for, in general, it may be said that the more completely the seed has ripened, the more thoroughly will the straw be exhausted of the most valuable nutritive material, and the harder and also more difficult it will become to masticate. From examination of the figures given by Collins and Thomas, it is evident that good oat straw has a higher feeding value than inferior hay.

In a more recent investigation, in Wales, into the chemical composition of barley grain and straw, this variation in feeding value was clearly indicated. It was shown that soil, altitude and the variety grown affect the percentage of the different constituents in both grain and straw. In the case of the straw the percentage of the various constituents varied within wider limits

than in the case of the grain; although even in the samples of grain examined there was a difference of as much as 40 per cent. between the minimum and maximum percentages of albuminoids or protein content.

Hay.—The variation in hay is influenced by type of herbage, manurial treatment, time of cutting, season, &c. According to Wood's figures, the following are typical analyses:—

	<i>Protein Content</i>	<i>Starch Equivalent</i>
Meadow hay (medium) ..	4.6	31
Seeds hay	4.9	24

The variation for meadow hay, however, may be anything between 20 and 40 for starch equivalent, and the digestible protein between 3.5 and 9.

The writer is inclined to think that seeds hay grown in the north of England and in Scotland possesses a higher average feeding value than is indicated by the figures given above. From analyses made in the Agricultural Department of Armstrong College it would appear also that 4½ lb. of seeds hay have about the same feeding value as 5 lb. of meadow hay. Variation in both types of hay is influenced in part by the proportion of clover present. This is clearly shown in figures given by the late T. B. Wood in an article, "Chemical Composition of Pasture Plants and Hay," from which the following is an extract:—

"There is, however, a very notable difference in composition between hay made from grasses and from leguminous plants. Average figures are given in the following table:—

PERCENTAGE COMPOSITION OF HAY MADE FROM GRASSES AND LEGUMINOUS PLANTS

	<i>Grasses</i>	<i>Leguminous Plants</i>
Protein	10	15
Fat	3	3
Carbohydrates ..	38	33
Fibre	28	26
Ash	7	7
Water	14	16
	100	100

DIGESTIBLE NUTRIENTS PER CENT. IN HAY MADE FROM GRASSES AND LEGUMINOUS PLANTS

	<i>Grasses</i>	<i>Leguminous Plants</i>
Protein	5	10
Fat	1	1.5
Carbohydrates ..	22	23
Fibre	15	12

"Average samples of meadow hay will approximate closely in percentage composition, and in content of digestible nutrients,

to the figures given above for hay made from grasses. This is because the percentage of leguminous plants in average samples of meadow hay is too small to cause an appreciable departure from the composition of grasses. In the case of hay made from meadows manured with basic slag, or from meadows whose herbage for any other reason contains over an average percentage of Leguminosae, the percentages of total and digestible protein will be appreciably higher."

As showing the effect of manurial treatment of old land hay, more especially with phosphates, on feeding value, the results from the Palace Leas old meadow plots at Cockle Park may be cited. These plots have been systematically treated for 32 years, and the hay cut from each plot has been weighed each year. In addition, the hays from the different plots were tested some years ago for feeding quality both by chemical examination in the laboratory and by feeding trials with sheep. When the hay from the unmanured plot is valued at 80s. per ton, that from the plot receiving an annual dressing of basic slag (in the light of the examination mentioned) is worth 93s. per ton, whilst that from the plot receiving basic slag and muriate of potash is worth 101s. 9d. per ton. This valuation is based mainly on the percentage of protein and carbohydrate constituents, determined by chemical analysis, correlated with the live weight returns from the experimental pens of sheep fed on the different lots.

Further, it should be noted that later research, notably that at the Rowett Institute, Aberdeen, has shown that there is an increased mineral content in judiciously manured herbage. Well-manured pastures or hayfields produce herbage with a high mineral content, partly through the enrichment such manuring gives to individual plants and partly through the growth and spread of plants naturally richer in minerals. Well-treated meadow hay fields are calculated, therefore, to yield hay rich in bone-forming material as well as in protein and the other food constituents.

The time or stage of cutting has also a marked effect upon the quality of the hay, whether new or old land. Warrington, in his *Chemistry of the Farm*, states that hay harvested before it comes into flower contains 17.7 per cent. of nitrogenous substances; if allowed to reach the stage at which normally cut, the figure is 11.2 per cent., and when fully ripe the percentage is only 8.5. The work done at Cambridge and elsewhere, in recent years, has shown that young grass is richer in protein than that allowed to mature and has, moreover, a higher digestibility percentage.

General Conclusions.—(1) From the foregoing observations, it is fair to deduce that strict accuracy in the framing of rations on the present basis is impossible, on account of the variation occurring in the food value of the home-grown foods which form so large a proportion of the rations fed to live stock. Fair accuracy is only possible if more account is taken of the variation in composition of home-grown foods from locality to locality and farm to farm.

(2) It is not practicable to secure chemical analyses showing the composition of the home-grown foodstuffs for each particular case, *i.e.*, before suggesting suitable rations for a farmer's live stock. At the same time, the approximate quality of these should be judged if possible, and the conclusion arrived at taken into account when making up the rations. In many cases, this is now being done, more particularly in the case of hay. In the past, bulk consideration alone received attention, but it is obvious that the quality of such foods should not be neglected when framing balanced rations, even though the determination of such quality is based upon estimate.

(3) More research is needed into the composition of our home-grown foods, the variation in these, and the causes of such variation. Until such research is carried out, the results of comparative tests of feeding rations, carried out at different centres in the country, can only have a very limited value and application.

REFERENCES

- Gilechrist, D. A., "Swedes, Turnips and Mangolds at Cockle Park." (*Jour. Min. of Agric.*, March, 1920, p. 1220.)
Collins, S. H., & Thomas, B., "The Sugars and Albuminoids of Oat Straw" (*Jour. Agric. Science*, Vol. XII, Part III, July, 1922.)
Sanders, H. G., "Notes on Feeding Stuffs" (*Jour. Min. of Agric.*, Dec., 1929, p. 891.)
Fagan, T. W., & Watkin, J. E., "The Chemical Composition of Barley Grain and Straw grown in Mid-Wales." (*Welsh Jour. of Agric.*, Vol. VI, pp. 248 and 249.)
"Guide to Cockle Park Experiments for 1930." *Bulletin, Armstrong College, Newcastle-upon-Tyne* (Univ. of Durham).
Wood, T. B., "Chemical Composition of Pasture Plants and Hay." (*Farm Crops*: Vol. III—"Pastures and Hay," p. 204, Gresham Publishing Co.)
Warrington, R., *Chemistry of the Farm*. (Vinton & Co., Ltd.)

CONTROL OF THE MEADOW FOXTAIL MIDGES

H. F. BARNES, B.A., Ph.D.,

Entomology Department, Rothamsted Experimental Station.

Necessity for Control.—Three species of gall midges,* belonging to the family of Cecidomyidæ, lay their eggs in the flower heads of meadow foxtail grass (*Alopecurus pratensis*). These midges are minute red or yellow gnat-like flies. The grubs, resulting from the eggs, feed on the seed or seed-producing parts of the flowers and prevent seed formation. Enormous numbers of grubs are frequently present in the grass heads. For example, in one Aberdeen sample, collected July 25, 1928, by Dr. G. D. Morison, under 4 per cent. of the florets contained seeds, while the remainder either contained or had contained grubs. Again, over 21,000 grubs of one species alone were obtained from 120 heads of grass collected in Dorset, June 26, 1929, by Mr. L. B. Hall. These grubs do not lower the quality of the grass grown for hay or pasture purposes, but if a seed crop is required control is an absolute necessity.

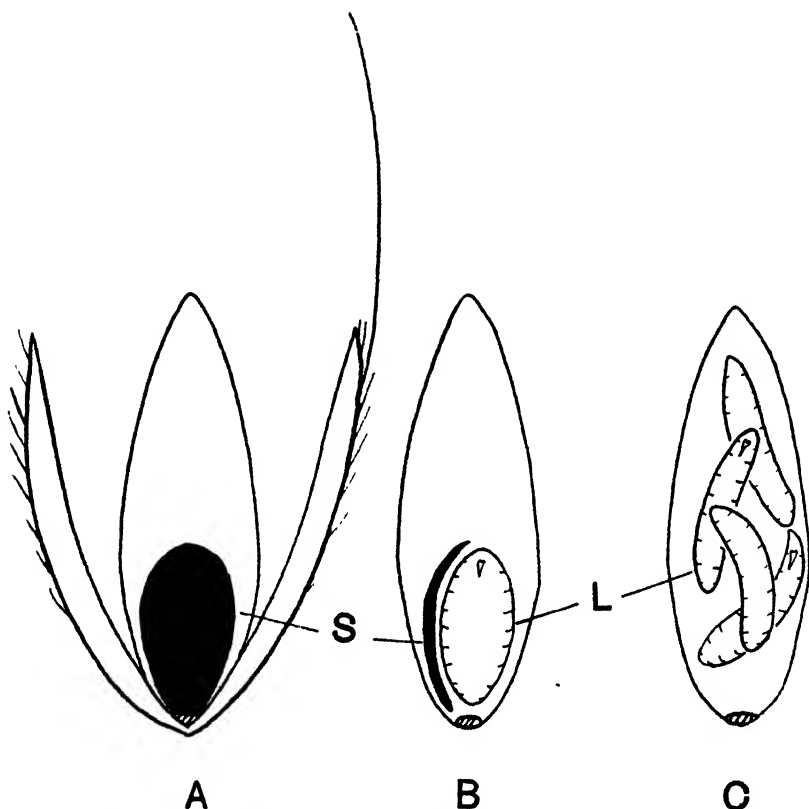
Distribution.—As far back as 1885, Miss Ormerod realized that there were two kinds of midges the grubs of which prevented seeding of this grass in Cheshire, but it was not till 1895 that Reuter described one of these species (*D. alopecuri*) as well as a third one (*S. geniculati*). The writer described the second of Miss Ormerod's species (*C. merceri*) in 1930.

In a recent survey, made between 1926 and 1929, all three species were found to occur in almost every county of England, as well as widely throughout Wales, Scotland and Ireland. The midges are also to be found in Finland, Denmark and New Zealand, having undoubtedly been accidentally introduced into the last-named country in seed imported from Europe.

Food Plant and Nature of Injury.—Meadow Foxtail grass (*Alopecurus pratensis*) is undoubtedly the most usual food plant, and, so far as is known at present, the only one of two of the midges. The other midge (*S. geniculati*) also attacks Marsh or Floating Foxtail grass (*Alopecurus geniculatus*).

The midges are injurious only in the grub stage, and although, in the case of two species, one grub destroys only one seed and, in the case of the other species, one or more

* *Dasyneura alopecuri* Reuter, *Stenodiplosis geniculati* Reuter and *Contarinia merceri* Barnes. For further detailed information concerning these midges reference may be made to *Ann. Appl. Biol.*, XVII, 2, May, 1930.



Diagrammatic representation of A, Meadow Foxtail grass floret containing half developed seed (S); B, floret attacked by grub of either *D. alopecuri* or *S. geniculati* showing the grub (L), which will stay in this position till the following spring, and the remains of the seed (S); C, floret attacked by grubs (L) of *C. merceri*—the grubs are full grown and ready to jump to the ground.

grubs are necessary to prevent one seed forming, yet these grubs are often present in such enormous numbers that very serious losses to seed crops result. All the three kinds of grubs damage the seed-producing parts of the flower.

Seasonal History in Great Britain.—During the winter, two of the three kinds of grubs are to be found in the seed cases that have dropped to the ground, while the third remains in the soil. All three are full-grown grubs merely awaiting the return of spring when they change into pupæ. The adult midges then soon emerge.

The midges of *D. alopecuri*, the females of which have red bodies, start emerging at the end of April and continue until very early July, but the greater number have emerged by the end of the second week in June. The grubs grow in

size for about seven weeks, and then remain in the seed cases until the following spring. Normally, this species has only one brood a year, although sometimes a few midges of a second generation may emerge in early August.

S. geniculati has two broods a year. The spring brood midges emerge in April and May, the resulting grubs feeding up very quickly; while the midges of the second generation are on the wing from June to August. The bodies of the female midges of the summer brood are bright red, while those of the spring brood are much more sombre in appearance. The date of appearance of the summer brood varies very considerably with the locality, being earlier in the southern and western areas than in the northern and eastern ones. The grubs of this species also remain in the seed cases till they emerge as midges either in the summer or following spring.

C. merceri usually has only one brood of flies a year, and this emerges from May to July, but occasionally a partial second brood appears during the period August to October. In the case of this midge, the grubs feed and grow up to full size very rapidly in from three to five weeks. Then, after a shower of rain, they crawl out of the empty seed cases and spring into the air, falling to the soil, in which they spend the rest of the summer, autumn and winter. The bodies of the females of this species are bright yellow.

The grubs of the three species may be very easily distinguished; those of *D. alopecuri* are orange to brick-red in colour, those of *S. geniculati* pale buff to salmon pink, and those of *C. merceri* bright golden yellow. As a rule only one grub of *D. alopecuri* or *S. geniculati* is to be found in one floret, and very often a crescent-shaped piece of the destroyed seed is found with them. On the other hand, up to 15 grubs of *C. merceri* can be found in one floret, and in the case of this species no trace of the seed remains, the explanation being that these grubs prevent the seed forming, whereas the two other kinds destroy the seed when it has formed. Subsequent to the migration of the grubs of *C. merceri* to the soil, the foxtail head seems to consist of "blind" florets and this is all that appears on the seed testers' tables. On the other hand, evidence of the other two midges is at once seen by the presence of the grubs.

Control Measures.—The only method of controlling these midges when they have become established is to prevent the grass from flowering until the bulk of the midges have

emerged. This may be done either by allowing sheep to graze on the grass or by rough cutting it ; then allowing the grass to flower and seed in the normal way. The date for closing down the field must be varied to suit the locality and be based upon biological observations. In localities where such observations have not yet been made, a trial and error method of cutting the grass up to certain dates, based on those used in the trial at Rothamsted, should be adopted. This method of control was tried successfully at Rothamsted in 1929. Plots of grass were cut at different dates and then closed down and allowed to mature, control plots, which were not cut at all, being also kept. The result was that the control plots had 80 per cent. of the seed destroyed, plots cut until April 29 had 44 per cent. destroyed, while plots cut until May 13 had only 11 per cent. of the seed destroyed. Care must be taken that cutting or grazing the grass is not continued too long, or the grass will not flower and produce seeds.

If the midges are not established in the area in which it is proposed to grow the grass for seed, care must be taken to sow seed free from midges. This can be done either by dry heating the seed for 35 minutes to a temperature of 59°-60° C. ; or by treatment with carbon bisulphide (1 gr. CS₂ to a litre of air) in a sealed room for nine hours ; or, although this treatment is less certain, by keeping the seed over for a year.

MARKETING NOTES

National Mark Eggs.—An unusual increase in supplies of home-produced eggs was reported at the end of August ; this was accompanied by a pronounced falling off in the demand in London, which was probably due in some measure to the absence of consumers on holiday. The result was a temporary slump in prices in the London markets, which, however, was soon succeeded by a reassuring firmness. One feature of the operations of the accredited agents of National Mark Egg Central, Ltd., has been a resumption of the former good demand for National Mark eggs of " Special Weight " grade.

During the six months, March to August, 1930, the authorized packing stations sold 132 million eggs, of which 94 million were consigned under National Mark labels.

National Mark Beef.—The number of sides (including quarters and pieces in terms of sides) of beef graded and

marked with the National Mark for the five weeks ended September 20 was as follows :—

Week ended			Select	Prime	Good	Total
LONDON						
August	23	..	542	910	50	1,502
"	30	..	412	983	36	1,381
September	6	..	308	761	34	1,103
"	13	..	685	942	24	1,651
"	20	..	643	1,085	41	1,769
BIRKENHEAD*						
August	23	..	68	367	—	435
"	30	..	31	484	14	529
September	6	..	20	356	4	380
"	13	..	110	496	2	608
"	20	..	148	645	—	793
SCOTLAND*						
August	23	..	1,966	587	—	2,553
"	30	..	1,633	493	—	2,126
September	6	..	1,720	578	—	2,298
"	13	..	1,816	567	—	2,383
"	20	..	1,916	652	—	2,568
TOTAL LONDON SUPPLIES (All Sources)						
August	23	..	2,576	1,864	50	4,490
"	30	..	2,076	1,910	50	4,086
September	6	..	2,048	1,695	38	3,781
"	13	..	2,611	2,005	26	4,642
"	20	..	2,707	2,382	41	5,130
BIRMINGHAM						
August	23	..	44	127	8	174
"	30	..	15	116	8	139
September	6	..	18	126	15	159
"	13	..	21	146	20	187
"	20	..	18	164	10	192

* Sides consigned to London.

The hot weather in the early part of September was naturally prejudicial to the sale of beef, but the trade revived in a satisfactory manner and the demand for National Mark beef remained firm. Hostile critics of the scheme have at times stated that there was no public demand for National Mark beef. It is difficult to prove the extent to which the public is asking for the beef in various districts, but an interesting sidelight is thrown on the subject by the visit of an Inspector to two shops in a London suburb early in September. In one shop, out of 14 customers who came to buy home-killed beef, 10 of their own accord especially asked for National Mark beef, while in the other shop, out of 17 customers, 15 asked for National Mark beef. Such figures indicate that housewives are realizing the advantages of being able to purchase a graded and guaranteed article, and now take the initiative in asking for it.

The situation in Birmingham has not changed during the past five weeks to an extent that reveals itself markedly in figures, but it is to be noted that the number of sides marked, 174, in the week ended August 23 was the highest recorded since June 1, and there are indications of the development of a more favourable attitude to the scheme within the meat trade.

National Mark Apples and Pears.—Although, as indicated in Marketing Notes in the August issue of this JOURNAL, the apple crop this year will not be so heavy as usual, the decreased quantity, which is largely confined to low-grade fruit, is to some extent compensated by an improvement in quality.

Covent Garden Market has already provided an instance of the popularity of National Mark apples. A recent display of fruit packed under the Mark was staged by a well-known wholesaler, with the result that he had considerable difficulty in meeting the demands of his customers.

National Mark Canned Fruit, Peas and Beans.—During September, supplies of National Mark canned fruit and vegetables were released for sale, and are now available in retail establishments all over the country. The Ministry has issued large supplies of an attractive show-card and window strip to authorized canners for distribution to retailers handling their products, and further publicity for National Mark canned produce is being given in the private advertisements of authorized canners and distributors. A good demand for National Mark canned produce is anticipated.

National Mark Dressed Poultry.—The authorized packers who are operating in this scheme report that there is a growing demand for National Mark poultry, and that they have some difficulty in meeting it. This state of affairs speaks well for the National Mark supplies that have so far been marketed, and although the scheme is at present only effective within a limited sphere a gradual development may be anticipated.

Publicity for National Mark Produce.—Four National Mark Weeks were held in September, viz., at Hereford (Sept. 5-11), Bedford (Sept. 22-27), Bradford (Sept. 24-Oct. 4) and Watford (Sept. 29-Oct. 4). The Hereford Week was organized to take advantage of the excellent opportunity to advertise the National Mark afforded by the Three Choirs Festival, which brought a large number of visitors to the City; an exhibition

of National Mark commodities was staged at the Shire Hall. At Bedford and Watford, exhibitions were staged at premises temporarily acquired for the purpose, while at Bradford a display was staged at the Third Annual Home, Industry and Fashion Exhibition which was held concurrently with the National Mark Week.

An interesting innovation in the way of advertising National Mark products is a National Mark Demonstration Motor Van, which is being run on a series of three tours in certain parts of Scotland under the auspices of the Department of Agriculture for Scotland. The first tour, which commenced on August 20, will embrace a number of holiday resorts, where it will be possible to bring National Mark products prominently before large numbers of tourists. The remaining two tours, which are to be conducted in October and early in the new year, will cover the larger towns. Small consignments of certain English National Mark commodities are being carried and displayed on the van. Samples will be sold to the public and the van will be decorated with some of the attractive display material which is supplied to retailers of National Mark commodities. Leaflets explaining the different National Mark schemes will also be distributed, and lists of the authorized packers in the schemes will be available for retailers so that they may be in a position to follow up the visit of the Demonstration Van by obtaining supplies.

The advertising of National Mark beef in Birmingham newspapers was continued throughout the month. On September 11, Mr. Ben Riley, M.P., addressed the Birmingham Labour Party with special reference to the National Mark beef scheme. A large number of women's organizations throughout Birmingham will be addressed by trained women speakers during coming months on the National Mark beef scheme from the woman's standpoint.

Displays of Home Produce.—Displays of home produce (including some National Mark commodities) have recently been staged at the International Bakers' and Confectioners' Exhibition (Sept. 6-12) and at the International Grocers' Exhibition (Sept. 20-26), both held at the Agricultural Hall, Islington. The accommodation provided by the Empire Marketing Board at these Exhibitions allowed of an exhibit entirely different from that normally arranged. The central feature consisted of a sample room for the "Trade" only, modelled somewhat on the lines of a Trade Exchange, with sufficient space for displaying samples and interviewing

traders ; a Traders' Club was available for the use of trade visitors. Only a limited amount of space was devoted to the display windows seen by the general public.

South Africa—Dairy Industry Control Act, 1930.—The main provisions of this Act are as follows :—

A Board of Control, incorporated under the Act, is established for the dairy industry, consisting of six milk producers, five creamery and cheese factory owners, two farm dairy buttermakers, and one representative of cheese and butter distributors ; the Chairman of the Council is to be an officer of the public service, but the remaining members are to be nominated by their respective industries.

The general functions of the Board are to co-ordinate the primary production, manufacture and marketing of dairy produce, to take measures to stabilize prices of dairy produce in the Union and generally to advise the Minister of Agriculture on all matters relating to the development of the dairy industry.

The Board's powers are wide. It may issue regulations governing export, may determine the minimum exportable quantities, and may assume control over produce intended for export. It can demand information from butter and cheese manufacturers and from warehousemen. In certain circumstances, it may also fix the minimum price to be paid to the producer for milk and cream.

The Board may also impose a levy on all butter, butter substitutes and cheese manufactured in or imported into the Union, which may be utilized :—

- (a) in paying an export bounty on butter and cheese ;
- (b) in stimulating the consumption of dairy produce ;
- (c) in providing marketing credit ;
- (d) in general measures to develop the dairy industry.

The Act, which is subsidiary to the Dairy Industry Acts, 1918-1926, also provides for such varied matters as compulsory marking and grading, compulsory purchase of milk by unit of butter-fat, the limitation in number of creameries and milk factories and the prohibition, in certain circumstances, both of the import and export of milk products. The powers under this paragraph are, however, exercised by the Government and not by the Board, though the latter is expected to advise the Minister on his exercise of certain of them.

The Act, which is rather long, is a striking mixture of two principles, regulation by the State and regulation by the industry. The application of the latter principle by the Control Board will be watched with interest,

South Africa—Agricultural Warehouse Act, 1930.—The object of this Act is to provide a system of licensed warehouses as a basis for the issue of negotiable warehouse receipts against agricultural produce in store. The form of warehouse receipt is prescribed by the Act. Such receipts are negotiable instruments against which the Land and Agricultural Bank of South Africa and the South African Reserve Bank are empowered to make advances; they may be endorsed by the holder for the purpose of conveyance of ownership or for deposit as collateral security. In the case of the Land Bank, receipts must be presented by any bank or co-operative society or company or by a credit society or loan bank under the Agricultural Credit Act, 1926. In the case of the South African Reserve Bank, receipts must be presented by any bank or by the Land Bank, and advances on such warehouse receipts may only be made up to 20 per cent. of its discounts. Provision is made for preserving in the store the identity of each parcel of produce covered by a warehouse receipt.

“Rail-surety-notes” may also be issued by the railway, port and harbour authority in respect of grain received for conveyance to a harbour for export—unless a warehouse receipt has already been issued for it—and such rail-surety-notes are equivalent to warehouse receipts, in so far as their use as collateral security is concerned.

Security must be lodged with the Minister of Agriculture in respect of every licensed warehouse in accordance with a monetary scale based on the maximum value of produce stored in the warehouse at any time during the currency of the previous licence. In the case of a new warehouse, the security required is £1,000. Before a licence is issued or renewed, the deposit of a fire insurance policy, for an amount not less than the security, may also be required. The nature, situation, construction and equipment of warehouses may be prescribed by regulations so as to ensure efficient and safe storage of produce deposited therein.

Warehousemen are bound to accept for storage any produce, of the kinds which they are entitled to store, that may be presented for storage, provided space is available.

The keeping of complete records by warehousemen, and the inspection of warehouses and records by the Minister of Agriculture, are provided for. A register of licensed warehouses, showing the location, capacity and kinds of produce which may be stored therein has to be kept by the Minister of Agriculture.

The Apple Industry of Nova Scotia.—The Royal Commission on the Apple Industry of Nova Scotia, appointed in February of this year, has recently submitted its report. The Commission expresses its belief that the principal need of the industry is the establishment of highly centralized control over the marketing of Nova Scotian apples by a single organization, which would act as a strong business executive for the industry, leaving growers free to devote their whole attention to the production of fruit. The Commission emphasizes the need for unanimous support of such an organization by fruit growers, and refers to the compulsion which, in certain countries, has been applied to recalcitrant growers where the majority desired to adopt an improved marketing system.

The recommendations of the Commission cover two main aspects of fruit marketing, viz. :—(1) the preparation of fruit for market, and (2) marketing organization.

(1) With a view to improving the condition in which Nova Scotian fruit comes on to the market, the Commission recommends compulsory inspection of all fruit, whether for Canadian consumption or export, and the taking of measures to ensure more uniform interpretation and more rigid observance of the existing fruit-grading regulations. Greater standardization of packages for apples, particularly for export, is also recommended. Other recommendations suggest certain forms of educational aid in fruit-growing technique and compulsory spraying of badly infested orchards.

(2) With the object of ensuring the centralized control of marketing, which is regarded as essential, the Commission recommends the creation of a new marketing organization, which might be known as the Consolidated Fruit Company of Nova Scotia, which should be empowered to acquire all the various existing fruit-marketing companies, the United Fruit Companies and such other organizations as might desire to become part of the new organization. Membership would be open to all fruit growers in the Annapolis Valley. Such an organization should not be brought into operation, however, until growers representing 50 per cent. of the apple crop of the Valley show themselves in favour of it.

The objects of such an organization would include the co-operative marketing of its members' apples and the maintenance of an agency in Great Britain; the co-operative manufacture and marketing of fruit products; the purchase of requisites for the fruit industry; the dissemination of information relative to the industry; and the provision of financial assistance for fruit growers.

The Company would be empowered to make deductions from the proceeds of sales of fruit in order to cover its operative costs and to build up an adequate reserve. A suitable trade-mark would be registered for its sole use.

It is recommended that the Company should receive State assistance in the form of a guarantee of its loan capital, raised for the purposes of acquiring the necessary fixed assets and of financing its members by means both of long-term loans and of temporary advances on fruit sold through the Company.

The compulsory pooling of prices received for fruit produced in any district covered by the Company's operations, provided 75 per cent. of the members in that district vote in favour of pooling, is also recommended.

OCTOBER ON THE FARM

WILLIAM LAWSON, M.B.E., N.D.A., N.D.D.,

Director of Agriculture for West Sussex.

Root Crops.—The period of lifting and storing root crops is now at hand. It is a great advantage to get potatoes into the clamp or pit in a fairly dry condition. Protection from light should be given as soon as possible, although exposure to a dry wind will be advantageous. Adequate ventilation is no less important than protection from frost, and the apex of the pit should be made to allow ample ventilation for a few weeks after storing.

Mangolds continue to grow during autumn, and lifting is usually delayed as long as it is considered safe to do so either from the point of view of interference by frost or from wetness in the land making carting difficult. Mangolds are still immature when lifted and changes go on in the clamp, so that ventilation should be attended to. Mangolds that are put direct into a root house under cover should be stored in a wet condition, and even in outside clamps the roots lifted in wet weather keep better than those lifted under very dry conditions.

Sugar beet is usually carted from the field to rail or factory without any storage. The tops and crowns of sugar beet are an important source of stock food. Wilting for about ten days is advisable before they are folded or carted off. When fed to cattle the quantity should be limited for the first few days and gradually raised to about 70 lb. per head per diem; there is often a tendency to overfeed with beet tops, a wasteful and injurious practice.

Seed Dressing.—The dressing of seed to destroy fungus spores which may be carried by the seed should not be neglected. It is common knowledge that very large losses are sustained annually in this country from attacks of parasitic fungi. The full extent of this damage may not be fully recognized even by scientific workers, still less by practical farmers who may have attributed crop failures, either partial or complete, to insect attacks or adverse conditions of soil or weather, whereas the real reason may be a fungus attack. Certain diseases such as Loose Smut of wheat and barley are carried in the seed itself and are not destroyed by surface contact dressings. In consequence it is important that the crop from which seed wheat or barley is selected should be free from these loose smuts.

Diseases such as Bunt in wheat, commonly called "Smut" or "Stinking Smut," are well known to wheat growers, and dressing the seed against this disease is widely practised. There are many proprietary dressings on the market, some designed to control Bunt only, while others combine a dressing to make the seed objectionable to birds. Copper sulphate is widely used and formalin has been much favoured. The essentials of a seed dressing are that it should be cheap, easy to use, effective in controlling disease, not injurious to the germination of the seed, and not producing a sticky condition which would interfere with drilling or sowing.

It is recognized that liquid dressings do not fulfil all these conditions. The use of a dry dressing which would control the disease is desirable. During the last few years copper carbonate ground to a very fine powder has been used with considerable success. About 2 oz. of copper carbonate are incorporated with a bushel of grain. The mixing requires to be well done and is best performed in an airtight chamber; a barrel with a spindle through it to enable it to be revolved is suitable, but special dusting machines are available. The worker should be protected from the dry dust, which is injurious if inhaled.

A proprietary substance, which can be applied in the same way, was used with success by D. G. O'Brien and E. G. Prentice in their experiments on the control of Leaf Stripe or Yellow Leaf in Oats (reported in the *Scottish Journal of Agriculture*, July, 1930). These experimenters obtained remarkable control and were able to reduce the disease to a negligible amount. It is possible that the practice of dry dressing will increase and may entirely supersede the wet dressings; seed merchants

may find it advantageous to supply dressed seed. For those who cannot get dry dressed seed and do not care to do it themselves, the formalin treatment can be recommended. The procedure is to heap the grain on a clean floor and sprinkle it with weak formalin (1 pint of commercial formalin to 40 gallons of water, or $\frac{1}{2}$ fluid ounce per gallon) at the rate of about $1\frac{1}{2}$ gallons per sack of grain. The grain is turned over until completely wetted and should then be heaped up and covered with sacks, which have also been moistened with weak formalin, for four hours. The grain is then spread out and allowed to dry, after which it should be sown as soon as possible. (An article on dry pickling of seed wheat to prevent Bunt appeared in the issue of this JOURNAL for August, 1930, p. 429.)

Stock in Autumn.—Pastures full of grass may be an inducement to leave young cattle out when it is inadvisable to do so. Many young cattle are spoiled every autumn by being left out too long on the pastures without supplementary feeding. It is at this season that parasitic troubles are most manifest. Hoose or husk is frequently found in young cattle under one year old. Where pastures are heavily stocked and closely grazed it is not infrequent for attacks of this trouble to be apparent as early as July, but there is more trouble during the later months. As soon as the disease is apparent steps should be taken to prevent a severe attack, and nursing of the affected animals is necessary. The stock should be moved to a fresh pasture if possible, and should be housed at night and fed with good hay and a few oats and linseed cake. Animals severely attacked should be treated by a veterinary surgeon.

Another disease which accounts for losses in young cattle is what is known to veterinary surgeons as parasitic gastritis. The disease is due to a mass infection of minute parasitic worms in the digestive system of the animal. Any undue wastage or loss of condition should not be neglected, and if accompanied by scouring the condition is serious.

Sheep are subject also to the same disease: the "Lincolnshire Lamb Disease," "Drying," "Double Scaup," or the general description "the worm," are all parasitic gastritis. Infested land, heavy stocking and close grazing are contributing factors. When the attack is slight a change to clean pastures, giving the stock a comparatively large range, will often prove a remedy. Affected cattle should be housed and well cared for. An article on the control of nematode parasites of sheep appears at p. 681 of this issue.

Liver Fluke.—A lookout should now be kept for attacks of this parasite. Sheep are the usual sufferers, but cattle are often attacked, as also may be rabbits.

The full life history of the fluke, including the part played by the fresh water snails, has been carefully observed. The young fluke, which is enclosed in a very small case or shell, is taken into the animal with grass or water. The fluke is liberated in the intestine; it bores through the wall and ultimately reaches the liver. Wet cloudy summers are favourable to the flukes and this means increased infection. The course of the disease depends on the extent of the infection. Mass infection may bring about the death of the sheep rather rapidly and without much loss of condition. Such cases are difficult, as little success has attended attempts to kill flukes newly picked up.

(Parasitic worms and live fluke in sheep are both dealt with fully in Bulletin No. 1 (*Some Diseases of Farm Animals*), a copy of which may be obtained from the Ministry, post free, for 1s. 6d.).

* * * * *

NOTES ON MANURES

H. V. GARNER, M.A., B.Sc.,
Rothamsted Experimental Station.

Observations on the Rothamsted Plots.—It may be of interest to put on record some of the more striking features of the field experiments at Rothamsted which have attracted the attention of visitors during the past season.

Wheat.—The greatest contrast on the farm has again been provided by the Broadbalk plots which demonstrate the marvellous increase in fertility resulting from a bare fallow. This year it has been possible to observe the classical series of manurial treatments on continuous wheat on the one hand, and on the first wheat crop after no less than four successive years of bare fallow on the other. The continuous wheat, which was in fact the third crop after two years fallow, presented the normal appearance of Broadbalk field, the dunged plot and those receiving full manurial treatment being fairly good crops although slightly lodged this year, while the unmanured plot and those without nitrogen were exceedingly short, thin and poor. All plots after the long fallow produced heavy crops which were exceedingly badly lodged where any nitrogen had been given and considerably twisted even on unmanured land or on land receiving no nitrogen. The crop

after fallow on the soil which had received no manuring since 1839 did not appear to be much inferior to that on the dunged land under continuous cropping ; while even the crops which had received heavy nitrogenous manuring had been put into quite a different class by the effects of the fallow. The result of two years of bare fallow in these plots was seen in 1928 when very heavy crops of wheat were produced, which in that favourable season stood up well. Everything goes to show the increase in fertility resulting from thorough cultivation, and it is reasonable to assume that the same effects are produced in minor degree by good cultivation carried out within the limits imposed by ordinary systems of cropping.

A set of four wheat varieties, Squarehead's Master, Swedish Iron, Million III and Yeoman II, were to be seen on one series of plots which had received 2 cwt. of sulphate of ammonia or its equivalent applied in two dressings, half in March and the remainder in May. In spring the plant was rather thin and stood well in spite of the rough and showery weather in July and early August. The land was in medium condition, and the indication was that 1 cwt. dressing, common in practice, might under certain circumstances be increased.

Barley.—On the Great Hoos permanent barley plots the well-known effect of superphosphate in promoting early maturity was particularly striking this year, and farmers had difficulty in believing that the sections with and without phosphate had been drilled on the same day. The effect on barley of the omission of potash is not usually marked on the clay soil at Rothamsted: the yield over a 76-year period being 39.3 bushels with complete manure and 35.8 bushels where potash is continually withheld. This season, the lack of potash was noticeable by a distinct tendency to lodge, whereas the completely treated barley was standing well, this being in harmony with the commonly-held view that potash tends to improve the straw of cereals.

A new rotation experiment has been set out on Hoos field, on a section which had been cropped with cereals for several years and received only nitrogenous manures. It was noticeable that the effect of phosphate in promoting maturity of barley was much more evident on the plots receiving superphosphate than on those receiving the same amount of phosphate in the form of finely-ground North African rock, indicating that the former was most active in the first year. The arrangement of the experiment permits of the residual effects of each of these manures to be followed out in a series of crops.

Seeds.—In another section of the same experiment heavy dressings of nitrogenous manures had been applied to first-year seeds and had produced big crops of hay; the effects of these dressings in promoting growth in the aftermath were very striking, although the proportion of clover in the herbage was less than in the untreated plots.

Forage Crops.—Where a series of mixtures of leguminous and cereal mixtures had been treated with various combinations of nitrogenous and mineral manures, the effect of the former in stimulating the cereals and the latter in helping on the leguminous plants was most marked. It remains to be seen whether protein will have been secured more economically by minerals or by nitrogen or by a judicious combination of the two. Possibly the extra carbohydrate produced on the plots receiving nitrogen will be the deciding factor.

Ammonium Phosphate.—Superphosphate was the first water-soluble phosphate made for agricultural use. First prepared on a small scale for use on the Rothamsted farm in 1840, it is now manufactured in enormous quantities, about 670,000 tons being used in England in 1928 when the world output approximated to 15 million tons. Superphosphate, however, contains about half its weight of gypsum, which is of comparatively little fertilizing value and serves to dilute the main constituent. In regions where manures have to be carried long distances, the need has been felt for some form of available phosphate of a more concentrated nature than ordinary superphosphate. This situation was first met by the introduction of so-called double superphosphate, which contains the same water-soluble compound of phosphoric acid (mono-calcium phosphate) as exists in ordinary superphosphate, but in this case without the gypsum. By this means the grade of the product is increased from about 16 to 40-50 per cent. of water-soluble phosphoric acid. This product is extensively made in the United States for economy in transport and handling on the farm. In both types of superphosphate, calcium is the base which is combined with the phosphoric acid, and sulphuric acid is consumed in the manufacturing processes, gypsum being made in both cases, but only appearing in the final product in ordinary superphosphate.

More recently improvements have been made in the manufacture of phosphoric acid from phosphate rock, and by combining the phosphoric acid with synthetic ammonia various phosphates of ammonia are produced which contain

water-soluble phosphoric acid in high concentration and also a considerable amount of available nitrogen. Two ammonium phosphates have been used for fertilizer purposes. Mono-ammonium phosphate, when pure, contains 61.7 per cent. of phosphoric acid and 12.2 per cent. of nitrogen, while di-ammonium phosphate has 53.8 per cent. and 21.2 per cent. respectively. Both are white crystalline substances and carry no combined water.

A further possibility is the preparation of potassium phosphate providing a concentrated source of potash and water-soluble phosphate. This substance contains, when pure, about 54 per cent. of potash and 41 per cent. of phosphoric acid.

A few experiments are already on record comparing the phosphates of ammonium and potassium (or mixtures containing the phosphate in these forms) with equivalent mixtures containing the phosphate as superphosphate. Thus, at Rothamsted in 1927, the following results were obtained with swedes :—

	<i>Tons per acre</i>	
	Roots	Tops
Superphosphate and sulphate of ammonia	14.99	5.28
Mono-ammonium phosphate equivalent	15.19	5.23
Standard error .. .. .	.22	.12

At Woburn in 1928 the yields of potatoes in a comparative experiment were:—

	<i>Tons per acre</i>
Complete fertilizer containing di-ammonium phosphate ..	13.0
Equivalent artificials containing superphosphate ..	13.8
Standard error .. .. .	.33
Potassium phosphate (no nitrogen)	11.9
Equivalent potash and superphosphate	12.05
Standard error .. .. .	.33

A difference exceeding three times the standard error may be regarded as a real one, *i.e.*, not due to accidental causes. In all the above comparisons, the differences do not reach this magnitude, and we may therefore say that these experiments bring out no difference in action between the forms of phosphate used. A good deal of further information with regard to these substances will, no doubt, shortly be forthcoming.

When to Apply Manures.—The broad lines with regard to the time of application of manures were indicated by the results of the early analyses of the drainage water from the wheat plots receiving different combinations of fertilizers at Rothamsted. It was found that very little phosphate or

potash appeared in the drainage even when large application of these manures had been made for a long series of years, whereas the loss of nitrogen and of lime was considerable. It was further found that the autumn application of sulphate of ammonia resulted in abnormally high losses compared with those suffered by spring dressings. The loss of lime, though not so serious as the wastage of nitrate because it is cheaper to replace, was greatest from plots receiving heavy and continuous dressings of sulphate of ammonia.

Since these experiments were carried out, a number of fertilizers have come into use which, although applied on the general lines indicated, present certain special properties which have to be taken into account.

Nitrogen.—The usual practice with all forms is to give these manures in spring. The more gradual their transformation into nitrate the more retentive the soil, and the lower the winter rainfall the less risk is run by seed-bed application to autumn-sown crops. For this purpose, calcium cyanamide or sulphate of ammonia may be suitable in certain circumstances, but evidence on this point is as yet scanty. The autumn application of farmyard manure is often desirable on the grounds of convenience, and this may outweigh the greater loss of nitrates which this practice entails.

Phosphate.—All forms of phosphate are retained by ordinary soils, but in practice a distinction may be drawn between the more soluble types such as superphosphate, dissolved bones and high-soluble basic slag on the one hand, and the more resistant bone meal, low-soluble basic slags, and ground rock phosphate on the other. The former class may be applied in autumn or spring as convenient; the latter probably have a better chance in arable cultivation by being well mixed with the soil in autumn, although precise experiments on this point are lacking.

Potash.—The potash salts in common use are water-soluble, and what has been said with regard to superphosphate applies to them also. If, for special reasons, low-grade potash salts are to be given to potatoes, autumn application is desirable, as this enables the accompanying chloride, which is injurious to potatoes, to be washed out while the potash is held back till required by the crop.

Lime.—The time for applying liming materials depends on considerations other than the above. The nature of the substance used is as a rule the deciding factor. Burnt lime

is a caustic substance and can be distinctly injurious to young germinating seedlings; it is therefore more suitable for winter than spring application. The same is true of lime products which are in either lumpy or pasty condition, *e.g.*, lump chalk and factory lime. Exposure to winter frost and thaw does much to reduce these materials to fine enough condition for subsequent cultivations to mix them with the soil. On the other hand, ground chalk and ground limestone are mild in their action and can be distributed very thoroughly.

PRICES OF ARTIFICIAL MANURES

Description	Average prices per ton during week ended September 10				
	Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) ..	9 7d	9 7d	9 7d	9 7d	12 1
Nitro-chalk (N. 15½%) ..	9 7d	9 7d	9 7d	9 7d	12 1
Sulphate of ammonia:—					
Neutral (N. 20.6%) ..	8 19d	8 19d	8 19d	8 19d	8 8
Calcium cyanamide (N. 20.6%) ..	8 5e	8 5e	8 5e	8 5e	8 0
Kainit (Pot. 14%) ..	3 6	2 19	2 15	2 18	4 2
Potash salts (Pot. 30%) ..	5 3	4 18	4 12	4 11	3 0
" (Pot. 20%) ..	3 15	3 9	3 3	3 6	3 4
Muriate of potash (Pot. 50%) ..	9 17	9 3	8 12	8 16	3 6
Sulphate,, (Pot. 48%) ..	11 19	11 6	10 12	10 11	4 5
Basic Slag (P.A. 15½%)|| ..	2 13c	2 3c	..	2 9c	3 1
" (P.A. 14%)|| ..	2 7c	1 16c	1 16c	2 3c	3 2
" (P.A. 11%)|| ..	..	1 9c	1 9c	..	..
Ground rock phosphate (P.A. 26-27½%)|| ..	2 2a	2 10a	2 5a	2 7a	1 9
Superphosphate (S.P.A. 16%) ..	3 11	..	3 9	3 6	4 2
" (S.P.A. 13½%) ..	3 5	2 18	3 3	3 0	4 4
Bone meal (N. 3½%, P.A. 20½%) ..	8 15	8 10	8 7	6 15	..
Steamed bone flour (N. ½%, P.A. 27½-29½%) ..	5 17b	5 15f	5 15	4 7	..

Abbreviations: N.—Nitrogen; P.A.—Phosphoric Acid; S.P.A.—Soluble Phosphoric Acid; Pot.—Potash.

* Prices are for not less than 6-ton lots, for delivery during the month, at purchaser's nearest railway station, unless otherwise stated. Unit values are calculated on carriage paid prices.

† Prices are for not less than 2-ton lots, net cash for prompt delivery *f.o.r.* in town named, unless otherwise stated. Unit values are calculated on *f.o.r.* price.

‡ Fineness 80% through standard sieve. § Prices for 6-ton lots *f.o.r.* at makers' works. || Delivered (within a limited area) at purchaser's nearest railway station.

• Prices for 6-ton lots; at Bristol, *f.o.r.* Bridgwater; at Hull and Liverpool, *f.o.r.* neighbouring works, and at London *f.o.r.* depots in London district.

¶ For lots of 4 tons and under 6 tons the price is 1s. per ton extra and for lots of 2 tons and under 4 tons 5s. per ton extra.

• Delivered in 4-ton lots at purchaser's nearest railway station.

f Delivered Yorkshire stations.

They may be used at any time and should have preference when it is desired to dress tender young crops in spring.

Organic Manures.—The high-grade and expensive organic manures are, as a class, readily converted into ammonia and nitrate and are therefore quite suitable for spring application. The more resistant types such as hair, feathers, shoddy and sewage sludge can be used as autumn dressings without much risk of loss.

NOTES ON FEEDING STUFFS

H. G. SANDERS, M.A., Ph.D.,

School of Agriculture, Cambridge.

Roots.—Few subjects have been more warmly argued than that of the desirability of roots for dairy cows. A few years ago every agricultural journal was full of the question, but now the “tumult and the shouting” have died down, and references to it are not so frequent. The pendulum of popular opinion has made the full swing, and, after a certain amount of irregular vacillation, seems to have come to rest somewhere near the centre of its range. There can be no doubt that roots have done much for British agriculture in the past: their introduction and spread in the early part of the eighteenth century revolutionized the management of stock. Up to that date it was difficult to winter stock, and those that were kept did very poorly, whilst many were slaughtered in the autumn and salted down for winter consumption: of the bad effect this had on human health, and of the prevalence of scurvy, enthusiasts on vitamins delight to speak. Agriculturists, however, will think first of the great impediment to the improvement of breeds of livestock that this necessity involved, and it is significant that the giants among the breed improvers arose directly the introduction of roots had made a continuous breeding policy possible. It is not to be wondered at, therefore, that farmers went to extreme lengths in their advocacy of succulent food for winter feeding: so great was the evidence of history that the desirability, or even necessity, of roots for the winter was hardly questioned for many years, and large quantities were generally included in the rations of all stock, especially dairy cows.

After the War, when the outstanding increase in expense by farmers was for labour, root crops became expensive to grow. Hence, when Mr. Boutflour showed that high milk yields could be obtained without including any succulent

food in the winter ration, it is not surprising that many farmers went to the other extreme, and regarded roots as an unjustifiable extravagance, and even asserted that they tended to depress yields. The adoption of the new system entailed, however, much more than the mere dropping of roots from the ration: balanced rations were fed where they had been unbalanced before, bulk was controlled, and in many cases three milkings a day were substituted for two. That much higher yields were obtained by herds managed on this system than they had ever reached before is generally admitted, but the reduction, or omission, of roots was only one part of it, and it is completely illogical to attribute the improvement to that factor alone. The whole question of the economic soundness of roots in the dairy ration is a wide one, but the first part of it is quite clear-cut and straightforward. That part is—are roots beneficial to milk yield when the other conditions are constant and when the ration is a good one? With the object of testing this the present Director of the University Farm and the writer carried out a trial at Cambridge, and in order to increase the data they were very glad to accept the offer of a neighbouring farmer, a careful feeder, to carry out a parallel trial on his farm.

The object was to try the effect of feeding roots and no roots throughout the winter, so that the method of having two lots of cows and changing the rations over in the middle was rejected. The method adopted was to select cows that had already had one lactation or more, during the winter of which they had been fed on normal lines, with 30 to 60 lb. of roots a day, and to feed them during the winter of their next lactation without any succulent food at all. Water was continually before all the cows (so that that factor was eliminated), and during the summer they were all treated alike. Thus the only difference between the treatment during the cow's control lactation (or lactations) and in her experimental one was in the winter feeding. Lactation records were standardized for such things as age by a series of correction factors that had been obtained from large numbers of records previously, and each cow's performance on the dry winter ration was compared with her performance on the normal succulent winter ration. In this way the great variation in milking ability from cow to cow was overcome (different cows were not compared, but the effects of different treatments on the same cow), and consequently the smallness of the numbers was atoned for to a large extent. Five cows had two successive

lactations on dry winter rations, and most had more than one on normal winter rations: these were averaged, the unit of comparison being the cow. On the University Farm thirteen cows figured in the experiment, and of these nine gave lower yields on the dry winter ration, whilst four gave higher. The average decreased yield in the whole lactation by feeding hay and no roots during the winter part of it was 8.2 per cent. This was not quite what statisticians call significant—that is, a difference as large as this might possibly, though of course very improbably, have been due simply to chance. On the private farm the results were very much more definite. Six cows figured and they all gave markedly lower yields on hay: the average decrease amounted to 18.3 per cent., and this certainly could not be attributed to chance.

Putting the two farms together the average loss was found to be 11.4 per cent. This figure again was too large to arise simply by chance, and so may be taken to show that in this experiment the elimination of roots from the winter ration had a definitely harmful effect on yield. Looking at it another way it may be said that on the two farms some 2,300 gallons of milk were lost in 24 lactations by feeding hay instead of roots during the winter.

The same question of the desirability of succulents was attacked by Mr. Jesse. He had been running a cow rationing scheme in East Sussex, and arranged all his returns in groups according to the amount of roots included in the ration. He found that the higher the amount of roots in the ration the higher was the yield. Subsequently Mr. Jesse very kindly sent all his data (including some he had collected since his own statistical inquiry) to the writer, who analysed them with the same objects in view. In all there were 2,252 returns: the average amount of roots fed per cow was 36 lb., this including 223 completely “dry” rations. Comparing these last with the remainder, the following facts emerged:—

223	herds receiving no roots :	average yield per cow =	20.3 lb.
2,029	“ “ roots :	“ “ “	= 22.5 “

The difference in favour of roots was therefore 2.2 lb., or 10.8 per cent. Here, then, roots had a good effect, and the rise in yield was extremely close to the figure (11.4 per cent.) found in the Cambridge experiment.

There is no doubt of the “significance” of the East Sussex result: the “no-roots” herds gave the lowest average yield, and the yield rose steadily as the amount of roots fed was increased. This result can be stated by saying that between

herd and herd the yield rose by $2\frac{1}{2}$ per cent. for every additional 10 lb. of roots fed per cow. The argument might be advanced that this was not on account of the roots, but due to the herds containing the highest yielding cows receiving the most roots.

This does not sound very probable, but the point can be met. Many herds sent in more than one return during a winter, so that it was possible to see if a change in the ration *in the same herd* brought any change in the yield. Here again the same result emerged, but the rise was somewhat toned down: the average increase in yield produced by an increase of 10 lb. of roots in the ration was found to be about $1\frac{1}{4}$ per cent.

This is rather interesting: from herd to herd the yield rises by $2\frac{1}{2}$ per cent. for every 10 lb. increase in roots, but if a particular herd has its root ration put up by that amount it only gives about one-half of that increase. An explanation of this would be provided by the view that roots raise the yield by keeping the cow in better condition: if this is so the general level of root feeding would be of more importance than comparatively minor alterations in the exact amount fed. This explanation is a reasonable one, for the best condition for a dairy cow is a moderately loose one, and roots certainly help in attaining this. The point has been made before in these notes that this loose condition is necessary, as it means a more rapid progress of the food through the body, and so is tantamount to raising the intestinal capacity. If roots are chiefly effective by speeding up the rate of digestion it may be that, though in general useful, they can be dispensed with without lowering yields if the other foods are carefully selected to give a fairly laxative mixture. This means that cows can be correctly fed without roots, but that it is easier with them.

There are other possible explanations of the fact that roots tend to raise yields. It has been shown that succulent foods contain substances which assist in the assimilation of minerals; they may have an effect in raising the total water intake of the animal; and it has also been suggested that they have a direct stimulating effect. A consideration of the question of specific actions of foods, however, must be postponed.

Roots are often objected to as bulky, but this is unreasonable in view of the fact that their starch equivalent (on a dry matter basis) is higher than that of what is usually substituted for them—hay. Taking roots at 10.7 per cent. dry matter and 5.5 starch equivalent per 100 lb., and hay as 84 per cent. dry matter with starch equivalent of 40.4 per 100 lb., it is seen that the starch equivalent of 100 lb. of dry matter in roots is

51.4, as compared with 48.1 for hay. It is true that the 100 lb. of dry matter in roots is accompanied by much water, but in view of the rapid rate of passage of this through the intestine, and of the fact that if not provided by the food it will be drunk, it can hardly be considered to contribute sensibly to bulk, as that word is generally used in animal feeding. Hay, however, would contain rather more protein.

Opinion now leans to the view that succulent foods are helpful in putting the yield up slightly. One or two experimental inquiries have given the opposite result, a few have indicated no effect for them, but most trials have come out in their favour. Practical experience also points in this direction, though, as in many other cases, practical men disagree very much. In Denmark, farmers have such faith in succulent foods that they are fed as the productive part of the ration—that is, the highest yielding cows get the most. In India provision of succulents is difficult, but if they can be obtained for the hot weather they are found not only to raise the yield, but also to have a very marked effect in keeping the cows in good health: this point was stressed in a book recently published on Indian crop production.*

The pendulum has completed its swing, and we find it unstable at either end: roots are beneficial to yield, but not essential. Without special precautions being taken to ensure a laxative condition of the cows, they are helpful and, on the average, raise the yield by about 10 per cent. This amount is fairly considerable and well worth aiming for if the roots can be produced cheaply. Thus we come to the advice commonly given to-day, that if a farmer can grow, under his conditions of soil and climate, heavy crops of mangolds, he should feed them in moderation (up to about 60 lb. a day); if the farm is unsuitable for root-growing, the crop is expensive to grow and consequently dear to feed, and then it may be good policy to avoid it; if, however, no succulent food is provided great care must be taken to keep the cows in the right condition, and, in general, a slightly lower yield must be expected.

* A. Howard: *Crop Production in India: A Critical Survey of Its Problems*, Oxford University Press.

DESCRIPTION	Price per qr.		Price per ton		Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.		Price per lb. starch equiv.	Pro- tein equiv.
	s. d.	lb.	£ s.	£ s.				£ s.	s. d.		
Wheat, British	—	—	8 10	0 11	7 19	72	2 2	1-16		9-6	
Barley Danubian	20 3	400	5 13	0 8	5 5	71	1 6	0-80		6-2	
" Persian	19 0	"	5 7	0 8	4 19	71	1 5	0-76		6-2	
" Russian	21 3	"	5 18*	0 8	5 10	71	1 7	0-85		6-2	
Oats, English, white	—	—	6 15	0 9	6 6	60	2 1	1-12		7-6	
" black and grey	—	—	6 0	0 9	5 11	60	1 10	0-98		7-6	
" Argentine	16 9	320	5 17	0 9	5 8	60	1 10	0-98		7-6	
" Chilean	16 9	"	5 17	0 9	5 8	60	1 10	0-98		7-6	
" German	23 3	"	8 3	0 9	7 14	60	2 7	1-38		7-6	
Maize, Argentine	30 0	480	7 0	0 9	6 11	81	1 7	0-85		6-8	
" South African	32 9	"	7 13†	0 9	7 4	81	1 9	0-94		6-8	
Peas, Japanese	—	—	18 15†	0 19	17 16	69	5 2	2-77		18	
Dari	—	—	8 0	0 10	7 10	74	2 0	1-07		7-2	
Milling offals—											
Bran, British	—	—	5 5	0 19	4 6	42	2 1	1-12		10	
" broad	—	—	6 0	0 19	5 1	42	2 5	1-29		10	
Middlings, fine, imported	—	—	6 10	0 15	5 15	69	1 8	0-89		12	
" coarse, British	—	—	6 5	0 15	5 10	58	1 11	1-03		11	
Pollards, imported	—	—	5 7	0 19	4 8	60	1 6	0-80		11	
Meal, barley	—	—	7 5	0 8	6 17	71	1 11	1-03		6-2	
" maize	—	—	8 15*	0 9	8 6	81	2 1	1-12		6-8	
" " South African	—	—	7 0†	0 9	6 11	81	1 7	0-85		6-8	
" " germ	—	—	6 12	0 13	5 19	85	1 5	0-76		10	
" locust bean	—	—	7 10	0 7	7 3	71	2 0	1-07		3-6	
" bean	—	—	10 15	1 2	9 13	66	2 11	1-56		20	
Maize, cooked flaked	—	—	9 0	0 9	8 11	83	2 1	1-12		8-6	
" gluten feed	—	—	6 15	0 17	5 18	76	1 7	0-85		19	
Linseed cake, English, 12% oil	—	—	11 0	1 6	9 14	74	2 7	1-38		25	
" " " 9%	—	—	10 7	1 6	9 1	74	2 5	1-29		25	
" " " 8%	—	—	10 0	1 6	8 14	74	2 4	1-25		25	
Soya bean cake, 5½% oil	—	—	9 0§	1 16	7 4	69	2 1	1-12		36	
Cottonseed cake—											
" " English, 4½% oil	—	—	5 5	1 4	4 1	42	1 11	1-03		17	
" " Egyptian, 4½%	—	—	4 15	1 4	3 11	42	1 8	0-89		17	
Ground-nut cake, 6-7% oil	—	—	6 15*	1 4	5 11	57	1 11	1-03		27	
Decorticated ground-nut cake, 6-7% oil	—	—	8 2	1 16	6 6	73	1 9	0-94		41	
Palm kernel cake, 4½-5½%	—	—	6 10*	0 15	5 15	75	1 6	0-80		17	
" " meal, 4½%	—	—	6 10§	0 15	5 15	75	1 6	0-80		17	
" " meal 1-2% oil	—	—	5 15§	0 16	4 19	71	1 5	0-76		17	
Feeding treacle	—	—	6 15†	0 8	6 7	51	2 6	1-34		2-7	
Brewers' grains, dried ale	—	—	5 0	0 16	4 4	48	1 9	0-94		13	
" " " porter	—	—	4 12	0 16	3 16	48	1 7	0-85		13	
Malt culms	—	—	6 0†	1 4	4 16	43	2 3	1-20		16	

* At Bristol.

† At Liverpool.

‡ At Hull.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of August and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative values of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, if palm kernel cake is offered locally at £7 per ton, then since its manurial value is 15s. per ton as shown above, the food value per ton is £3 5s. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 1s. 8d. Dividing this again by 22-4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 0-89d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculation a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own markets. The figures given in the table under the heading manurial value per ton are calculated on the basis of the following unit prices:—N., 8s. 0d.; P₂O₅, 2s. 11d.; K₂O, 8s. 0d.

Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follow :—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (imported)	71	6.2	5 13
Maize	81	6.8	7 6
Decorticated ground nut cake	73	41.0	8 2
„ cotton cake	71	34.0	8 15

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 1.71 shillings, and per unit protein equivalent, 1.48 shillings. An explanation of the method of calculation employed is given in the Report of the Departmental Committee on Rationing of Dairy Cows.*

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The “food values” which it is recommended should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows are given in the November, 1929, issue of the Ministry's JOURNAL.)

FARM VALUES

CROPS	Starch equivalent Per cent.	Protein equivalent Per cent.	Food value per ton, on farm £ s.
Wheat	72	9.6	6 17
Oats	60	7.6	5 14
Barley	71	6.2	6 10
Potatoes	18	0.6	1 12
Swedes	7	0.7	0 13
Mangolds	7	0.4	0 12
Beans	66	20.0	7 2
Good meadow hay	37	4.6	3 10
Good oat straw	20	0.9	1 15
Good clover hay	38	7.0	3 15
Vetch and oat silage	13	1.6	1 5
Barley Straw	23	0.7	2 0
Wheat straw	13	0.1	1 2
Bean straw	23	1.7	2 2

* Obtainable from H.M. Stationery Office, Adastral House, Kingsway, W.C. 2, price 6d. net.

* * * * *

MISCELLANEOUS NOTES

PRICES of agricultural produce during August were on the average 35 per cent. above those ruling in the corresponding month of the base years 1911-13, as

The Agricultural Index Number compared with 34 per cent. in July and 52 per cent. in August, 1929. Prices

were fairly steady during the month under review and the rise of one point in the index number was due to a number of small alterations in the individual indices, principally those of fat cattle, pigs, cereals and potatoes, partially offset by those for fat sheep and hay. In comparing with last year, however, it should be borne in mind that although a large number of commodities were dearer than at present, milk prices in August, 1929, were fixed at winter levels, whereas in August, 1930, summer prices ruled.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1925 :—

Month	Percentage increase compared with the average of the corresponding month in 1911-13.					
	1925	1926	1927	1928	1929	1930
January	71	58	49	45	45	48
February	69	53	45	43	44	44
March	66	49	43	45	43	39
April	59	52	43	51	46	37
May	57	50	42	54	44	34
June	53	48	41	53	40	31
July	49	48	42	45	41	34
August	54	49	42	44	52	35
September	55	55	43	44	52	—
October	53	48	40	39	42	—
November	54	48	37	41	44	—
December	54	46	38	40	43	—

Grain.—Both wheat and barley were 1d. per cwt. dearer in August than in July, but oats were reduced by a similar amount. The index number for wheat rose by 2 points to 4 per cent. above pre-war, but barley was unchanged at 12 per cent. below 1911-13. In the case of oats the fall in price was proportionately much less than that recorded in the base years, and the index figure advanced by 7 points to 13 per cent. less than pre-war. A year ago wheat was 46 per cent., barley 31 per cent., and oats were 30 per cent. dearer than in 1911-13.

Live Stock.—Average values for fat cattle were unchanged on the month, but as a reduction occurred in the base years the index number was 7 points higher at 37 per cent. above pre-war. Fat sheep were about $\frac{1}{2}$ d. per lb. cheaper at 62 per

cent. in excess of pre-war, while prices of both bacon pigs and pork pigs rose by 6d. per score lb. and the relative index figures by one point to 41 and 50 per cent. above 1911-13. Quotations for dairy cows continued to move upwards, the average price in August showing an advance of about 13s. per head over the July figure. Store cattle, however, sold at slightly reduced prices and store sheep were fully 4s. 6d. per head cheaper on the month: the index for the latter fell by 12 points to 66 per cent. above the level of the base years. Following a series of comparatively small reductions since March last, values for store pigs moved upwards in August, and the index number was 12 points higher at 112 per cent. in excess of 1911-13. In August, 1929, the index figure for store pigs stood at 85 per cent. above pre-war.

Dairy and Poultry Produce.—Milk was unchanged either in price or index number, but butter prices rose by about 1½d. per lb. and the index figure by 2 points. Cheese was a little cheaper than in July and the index number was 4 points lower at 28 per cent. in excess of the level of the base years. As is customary at this time of the year, eggs realised higher prices, the average in August advancing by about 1½d. per dozen. The increase, however, was proportionately less than in the corresponding period of 1911-13 and the index number at 40 per cent. above pre-war was 4 points lower than in July. This level is below any recorded for August since 1915. Values for poultry receded further, a decline of 4 points being recorded in the index figure.

Other Commodities.—Prices of first early potatoes fell by fully 35s. per ton during the month under review, but as the reduction was proportionately less marked than in the base years, the index figure showed an advance of 2 points to 25 per cent. over pre-war. A year ago, the corresponding figure was only 2 per cent. above 1911-13. Quotations for hay were again lower, clover hay declining by about 9s. per ton and meadow by 1s. 6d., the composite index figure for both varieties showing a fall of 3 points to 15 per cent. above 1911-13. Fruit prices in August fell to below pre-war levels, apples being about 5 per cent. and plums about 10 per cent. cheaper. At the corresponding period in 1929, apples were realizing about 30 per cent. more than pre-war and plums more than double their present prices. Green vegetables, at 54 per cent. above the level of the base years, were rather cheaper than in July. Wool showed no material change either in price or index number.

Index numbers of different commodities during recent months and in August, 1928 and 1929, are shown below :—

Percentage Increase as compared with the Average
Prices ruling in the corresponding months of
1911-13.

Commodity	1928	1929	1930			
	Aug.	Aug.	May.	June.	July.	Aug.
Wheat	30	46	11	7	2	4
Barley	58	31	—1*	—4*	—12*	—12*
Oats	49	30	—11*	—16*	—20*	—13*
Fat cattle	40	36	30	27	30	37
Fat sheep	59	59	63	66	66	62
Bacon pigs	36	60	61	46	40	41
Pork pigs	33	60	67	52	49	50
Dairy cows	33	35	29	29	32	35
Store cattle	29	19	28	28	29	30
Store sheep	55	64	46	65	78	66
Store pigs	26	85	108	101	100	112
Eggs	55	59	28	29	44	40
Poultry	45	47	64	57	47	43
Milk	55	93	55	55	58	58
Butter	54	48	23	24	31	33
Cheese	84	62	52	42	32	28
Potatoes	35	2	—36*	—40*	23	25
Hay	13	41	28	25	18	15
Wool	76	47	Nil	—1*	—4*	—5*

* Decrease.

* * * * *

THE Annual Report of the National Institute for Agricultural Botany covering the season 1928-29 and the series trials which were concluded in that season **National Institute** has now been received (Journal of the of Agricultural Institute, Vol. II., No. 3, 1930. Heffer **Botany : Report** & Sons, Ltd. Price 2s. 6d. net). The series trials ended in 1929, included in the report, are those of Spring Sown Barleys, Spring Sown Oats and Maincrop Potatoes. The conclusions drawn from these trials are, in the opinion of the Institute, of definite value to the farmer as they show the relative value of the varieties tested. In addition to these reports there are reports on "Cereal Crops in Essex, 1927-28," the "Lord Derby Gold Medal Potato Trials, 1929," the "Report of the Potato Synonym Committee, 1929," and the "Eleventh Annual Report of the Official Seed Testing Station for England and Wales (1927-1928)." The report is concluded by an interesting paper on "The Work of the Institute," by E. S. Beaven, LL.D., which describes in summary form the whole of its activities.

NUMBER and declared value of animals, living, for breeding, exported from Great Britain and Northern Ireland during the three months ended **Export of Breeding Stock** June, 1930, compared with the corresponding period of 1929. (From returns supplied by H.M. Customs and Excise.)

Country to which exported	April to June, 1930		April to June, 1929	
	Number	Declared value	Number	Declared value
CATTLE		£		£
Argentina	140	22,255	185	45,878
Brazil	28	2,485	82	7,715
Chile	1	112	13	1,255
Uruguay	41	5,280	47	7,965
United States of America	57	5,183	30	3,250
Australia	50	5,400	47	11,243
Canada	226	15,335	179	15,225
Irish Free State ..	489	14,119	604	12,832
Kenya	15	914	7	375
Southern Rhodesia ..	6	346	19	1,995
Union of South Africa ..	17	1,082	45	2,837
Other countries ..	12	637	36	2,812
Total	1,082	73,148	1,294	113,382
SHEEP AND LAMBS				
Argentina	2	50	42	940
Brazil	84	1,845	85	1,271
Chile	9	380	3	375
France	37	344	39	444
Sweden	27	612	0	0
United States of America	122	1,847	130	1,085
Uruguay	0	0	15	205
Canada	369	6,102	13	195
Irish Free State ..	14	158	16	317
Union of South Africa ..	54	685	12	225
Other countries ..	20	427	40	856
Total	738	12,450	395	6,513
SWINE				
Denmark	0	0	29	520
France	9	145	1	10
Germany	10	360	5	60
Netherlands	3	42	0	0
Poland	1	25	5	170
Portugal	3	120	3	60
Irish Free State ..	48	600	49	257
Union of South Africa ..	9	230	10	261
Other countries ..	4	117	12	412
Total	87	1,639	114	1,750

THE 14th Egyptian General Industrial and Agricultural Exhibition will be held for one month, beginning on February 15, 1931, in the grounds of the Royal Agricultural Society at Gezirah, Cairo—under the patronage of King Fouad. A special committee, under the Chairmanship of Abbas Pasha El Daramalli, has been appointed to control the organization of the exhibition, the objects being the same as those of the exhibition held in 1926, i.e., the development of Egyptian agriculture and industry and the promotion of the use of agricultural machines and accessories. Exhibits from abroad will, therefore, only be admitted if they have a direct interest for agriculture. The Direction will welcome the co-operation of overseas manufacturers of machines, implements and other articles within the scope of the Exhibition, which are suitable for use in Egypt.

Requests for space should be addressed to the Directeur de l'Exposition Générale Agricole et Industrielle—B.P. 63, Le Caire, Egypt.

* * * * *

THE Seventeenth Annual Report of this Station, covering its activities and development during 1929, has been issued.

**East Malling
Research Station
Report**

The reception of a number of post-graduate research workers has been arranged for on the invitation of the Empire Marketing Board, and it is stated that a Technical Officer who has been appointed will devote part of his time to shepherding these students. The arrangements for the accommodation of the Imperial Bureau of Fruit Production at the Station, mentioned in the Report, have already been described in this JOURNAL (July, 1930). New premises, known as the Ditton Laboratories, near the entrance of the Station, will come into occupation of members of the staff of the Cambridge Low Temperature Station and it is hoped that the grading and packing organization will be working in close collaboration with their new neighbours by the time this note appears.

A section of the report deals with the Station Farm during the year and supplies interesting details of the conditions of the work and of the crops harvested. As might be expected, however, the main body of the report is devoted to a brief progress report of investigations undertaken for fruit growers and summaries of their results. A list of the published reports

by members of the staff of the Station is included. Both of these questions cover a wide range of subject matter, well known to horticultural readers of this JOURNAL. The Report is distributed free to Associate Members of the Station, and its price to non-members is 2s. 6d. net, plus 6d. postage.

* * * * *

THE following awards of special research grants for 1930-31 have been made on the recommendation of the Advisory Committee on Agricultural Science :—

Special Research Grants	<i>Institution</i>	<i>Investigation</i>	<i>Amount</i>	<i>Investigator(s)</i>
			S = Salary	
			E = Expenses	
			£	

I—Renewals

Bangor	Kemp in the fleece of Welsh Mountain Sheep.	E 150	R. G. White and J. A. Fraser Roberts
Bristol, Long Ashton Research Station.	Long Ashton winter washes.	E 150	C. L. Walton, F. Tutin and L. N. Staniland.
Cambridge, Department of Animal Pathology.	Use of B. C. G. Vaccine	E 375	Prof. J. B. Buxton and Dr. A. S. Griffith.
Cambridge, School of Agriculture.	Grassland investigations.	E 200	Pasture Sub-Committee of the Advisory Committee.
Cambridge, School of Agriculture.	Good and bad fields of wheat.	S 300 E 30	G. A. Stevenson.
Liverpool University.	Pregnancy disease in ewes.	E 200	Prof. S. H. Gaiger and K. D. Downham.
Oxford, School of Rural Economy.	Breeding of oats for resistance to frit fly.	E 273	N. Cunliffe.
Rothamsted Experimental Station.	Examination of data collected under the Agricultural Meteorological Scheme.	S 165* E 55	J. O. Irwin.
Wye, South-Eastern Agricultural College.	Struck and gangrene diseases in sheep on Romney Marsh.	E 350	A. D. McFwen.

II—New Grants

Cambridge, School of Agriculture.	Study of effects of stubble cleaning.	S 300 E 30	W. A. Jones.
Reading University.	Solids-not-fat in milk.	S & E 200	H. H. Nicholson and Assistant.
Seale Hayne Agricultural College.	Crossing of broccoli	E 116	F. R. Horne.

* Grant for six months for termination of investigations.

THE number of candidates this year for scholarships offered by the Ministry for the sons and daughters of agricultural workmen and others was 611, and 133 awards have been made. These comprise 12 senior scholarships for either degree or diploma courses in agriculture or an allied subject at the Universities and Agricultural Colleges; 111 junior scholarships for short courses not exceeding one year, tenable at Farm Institutes; and 10 extended junior scholarships for courses of further instruction at Farm Institutes.

The origins of the successful candidates this year, as compared with those in the three previous years, are set out in the following table :—

Occupation of Parents	1927	1928	1929	1930
Agricultural Workman	36	34	38	39
Working Bailiff	8	8	6	17
Smallholder	29	29	33	21
Other rural occupations (e.g., blacksmith, harness maker, market gardener, etc.)	11	12	19	19
Candidates who qualified on their own account as <i>bona fide</i> workers in agriculture	35	27	26	37
	119	110	122	133

THE following arrangements have been made for foreign studies of post-graduate agricultural teaching and agricultural research scholars of the Ministry of Agriculture in the academic year, 1930-31 :—

(1) AGRICULTURAL TEACHING SCHOLARS

Scholar	Subject	Centre of Study
Jones, W. H.	Economics	Harvard (Prof. J. D. Black).
Edwards, J.	Live Stock Improvement.	Minnesota (Dr. Eckles).
Hirst, H.	Animal Husbandry.	Ditto.

(2) AGRICULTURAL RESEARCH SCHOLARS

Bogue, J. Y.	Veterinary Physiology	Berlin (Prof. Cremer).
Bell, G. D. H.	Plant Genetics	U. S. A. Bureau of Plant Industry Stations.
Catchpole, H. R.	Animal Nutrition	California.

Grants for travelling and maintenance purposes are being made to these scholars in respect of the cost entailed by these programmes of study.

THE sixth annual award of scholarships from the United Dairies Scholarship Fund has recently been made. This fund, which amounts to £30,000, was created in 1924 by the United Dairies, Ltd., for the purpose of promoting and encouraging practical and scientific education in dairying and dairy farming. The fund also provides for one or more travelling and research scholarships to enable advanced students to study these subjects at home and abroad. The trustees and executive committee of the fund are :—Mr. A. L. Hobhouse (Chairman) representing the Somerset County Council ; Mr. H. E. Dale (Trustee) representing the Ministry of Agriculture and Fisheries ; Mr. E. W. Langford (Trustee) representing the National Farmers' Union ; Mr. J. F. Phillips (Trustee) representing the United Dairies, Ltd. ; and Professor H. A. D. Neville representing the University of Reading.

The scholarships, which are open to the sons and daughters of farmers and smallholders in Somerset, Cornwall, Devon and Dorset, are tenable at Reading University, the Seale-Hayne Agricultural College (Newton Abbot, Devon), and the Somerset Farm Institute (Cannington, Bridgwater). Nine ordinary scholarships were awarded this year, the successful candidates being as follows :—

Two Years' Diploma Course in Dairying at Reading University:—

John Vyvyan Berryman and John Boyce Fry.

One Year's Extension of Diploma Course in Dairying at Reading University:—

Raymond Herbert Weeks.

One Year's Extension of Course at Seale-Hayne Agricultural College:—
John H. Cock.

One Year's Course in Dairying at Somerset Farm Institute, Cannington:—

Miss Muriel Eileen Cottle, Miss Violet Hiscock, Jack Elliott Mellish, Miss Sylvia A. T. Osborn, Miss Muriel Irene Passmore.

Mr. R. H. Weeks was awarded a two-years' course at Reading University in 1928 and Mr. J. H. Cock was awarded a two-years' course at Seale-Hayne Agricultural College in 1926. The awards now made will enable them to continue their training in dairying work.

The terms and conditions of both ordinary and research scholarships for next year will be issued about May, 1931.

DURING the forthcoming winter it would be possible for Mr. H. V. Garner, the Guide Demonstrator at the Rothamsted Experimental Station, and other members of the staff whose names are appended, **Rothamsted Winter Lectures** to give a few lectures to Chambers of Agriculture and Horticulture, Farmers' Clubs, Farm Workers' Associations, Agricultural Societies, etc. The lectures would deal with the Rothamsted Experiments, and the titles of lectures and names of lecturers are given below. It is not practicable to deal with more than one subject in a single lecture. Bodies who would care to avail themselves of the services of the lecturers named should indicate the subject or subjects which would be of most interest to them, when an endeavour would be made to arrange for the lectures on the dates desired. The longest possible notice is requested.

A fee will not be charged for the lecturers' services, but any Association engaging them would be expected to defray their travelling and hotel expenses and to make such arrangements for the lectures as may be necessary.

All communications regarding lectures should be addressed to *The Secretary, Rothamsted Experimental Station, Harpenden, Herts.*

LECTURES BY MR. H. V. GARNER, M.A., B.Sc. (*Guide Demonstrator*)

- (1) Some principles of manuring and their application on the farm.
- (2) The use of fertilizers on grass land.
- (3) Experiments with sugar beet.
- (4) The manuring of potatoes in the light of recent experiments.
- (5) Nitrogen for cereals : some points in its use.
- (6) Some results of the Rothamsted Experiments on commercial farms.
- (7) Experience with the newer fertilizers.

OTHER LECTURES

- (1) *Soil Micro-Organisms (Bacteria, Protozoa, etc.)*

Lucerne Inoculation	Dr. H. G. Thornton, B.A.
Life in the Soil	
Biological Aspects of Partial Sterilization	Mr. D. W. Cutler, M.A.
- (2) *Agricultural Botany*

Weeds of Arable and Grass Land	Dr. Winifred E. Brenchley, F.L.S.
--------------------------------	-----------------------------------
- (3) *Agricultural Chemistry*

Liming and Chalking of Soils	
Recent Developments in the Production and Use of Fertilizers	Dr. E. M. Crowther, F.I.C.
- (4) *Soil Physics*

Soil Acidity : Its Cause and Control	Dr. R. K. Schofield, M.A.
Modern Developments in Soil Cultivation	Mr. G. W. Scott Blair, M.A.

(5) *Entomology*

Insect Pests

Dr. A. D. Imms, M.A.,
F.R.S.

Bee Keeping

Mr. D. M. T. Morland, M.A.

Fruit Pests

Dr. H. F. Barnes, B.A.

(6) *Mycology*Plant Diseases : their Causes and
Control

Dr. W. B. Brierley, F.L.S.

Soil Fungi and Plant Growth

Fungous Diseases of Crops

Virus Diseases of Plants

Dr. J. Henderson Smith
B.A.

Dr. J. Caldwell, M.A.

Plant Diseases : their Causes and
Control

Bacterial Diseases of Crops

Mr. R. H. Stoughton, B.Sc.

* * * * *

THE Ministry has been informed that a Decree has recently been issued prohibiting the importation into Germany of flower bulbs, tubers, etc., unless they are accompanied by an official certificate of freedom from certain diseases and pests specified in the Decree.

**Importation of
Flower Bulbs
into Germany**

The issue of such certificates involves examination of the bulbs, and the Ministry will be prepared to undertake this inspection in accordance with the arrangements already in force for the examination of plants, etc., destined for export to other countries for which health certificates are required.

* * * * *

THIS Scheme, having for its object the improvement of the productive quality of milch goats kept by smallholders, cottagers and others of similar position, is again in operation. For the current breeding season, which lasts till February 28 next, 105 stud goats have been registered and are standing at various centres throughout the country, including 11 in Wales, and their services are available for goats belonging to persons in the above-mentioned categories at a nominal fee, in no case exceeding 5s. Conditions of service and other information may be obtained from the County Agricultural Organizers at their respective County Education Offices, or from the Honorary Secretary of the British Goat Society, which is responsible for the administration of the Scheme, at 10 Lloyd's Avenue, London, E.C.3.

**Stud Goat
Scheme,
1930-31**

APPOINTMENTS

COUNTY AGRICULTURAL EDUCATION STAFFS : ENGLAND.

Bedfordshire : Miss F. M. Hill, N.D.P., has been appointed Instructress in Poultry-keeping, *vice* Miss D. Thompson.

Buckinghamshire : Mr. E. H. Brant, B.Sc., N.D.A., has been appointed Assistant Instructor in Agriculture.

Mr. C. Turner, N.D.A., N.D.D., has been appointed Assistant Instructor in Dairying.

Mr. W. R. W. Barnett* has been appointed Assistant Instructor in Horticulture.

Cheshire : Mr. R. G. Druce, B.Sc., B.Agric., has been appointed Lecturer in Biology at the Cheshire School of Agriculture, *vice* Mr. F. W. Hankinson, B.Sc., appointed District Lecturer in Agriculture.

Mr. H. Fairbank has been appointed Head Gardener at the Cheshire School of Agriculture, *vice* Mr. P. Shaw.

Cumberland and Westmorland : Miss B. Lang, N.D.P., has been appointed Assistant Poultry Instructress at the Newton Rigg Farm School, *vice* Miss Pringle, N.D.D., C.D.P.

Devonshire : Mr. R. D. H. Bridge has been appointed Assistant Instructor in Poultry Keeping, *vice* Mr. E. V. Beard.

Dorsetshire : Mr. R. Wightman, B.Sc., has been appointed Senior Agricultural Lecturer and Adviser.

Gloucestershire : Mr. T. H. Lunson, N.D.A., N.D.D., has been appointed Assistant Instructor in Agriculture, *vice* Mr. R. Line.

Hampshire : Miss M. Davies-Cooke, N.D.D., B.D.F.D., has been appointed Instructress in Dairying at Sparsholt Farm Institute, *vice* Miss G. Bowden.

Mr. W. Inglis has been appointed Manager of the County Egg Laying Trials, *vice* Miss E. M. Hissett.

Isle of Wight : Mr. B. Jenkins, M.Sc., has been appointed County Agricultural Education Officer.

Lincolnshire (Holland) : Mr. D. E. Horton has been appointed Assistant for Bulb Research.

Staffordshire : Mr. J. T. Craig, N.D.A., has been appointed Assistant Instructor in Agriculture.

Mr. J. Cooke has been appointed Manager of the County Egg Laying Trials, *vice* Mr. R. D. Scott.

Suffolk (East and West) : Mr. W. Longwill has been appointed Manager of the joint County Egg Laying Trials.

Wiltshire : Mr. T. C. Goddard, B.Sc., N.D.D., has been appointed Assistant Organizer for Dairy Husbandry.

* Wholly employed by the County Council, but only partially on agricultural education work.

WALES.

Carmarthenshire : Miss Eira Jones has not accepted the post of Instructress in Rural Domestic Economy, the notification of her appointment in the July, 1930, issue of this JOURNAL is cancelled, and the post remains vacant.

Monmouthshire : Mr. E. W. Hobbis has been appointed Assistant Instructor in Horticulture.

Mr. F. R. Wallbutton has been appointed Assistant Instructor in Poultry Keeping.

CHADACRE AGRICULTURAL INSTITUTE (Hartest, Bury St. Edmunds)

The following appointments have been notified as taking effect as from October 1, 1930 :—

Mr. J. R. Carter, Dip. Agr. (Wye), has been appointed Vice-Principal, *vice* Mr. G. L. Maw, B.Sc.

Miss E. M. Watson, N.D.D., U.D.A., has been appointed Instructress in Dairying and Poultry Keeping, *vice* Miss M. C. Thomas, N.D.D., B.D.F.D.

Mr. P. W. L. Hook has been re-appointed Third Master for the Winter Session, 1930-31.

PRINCIPAL WHOLE-TIME MEMBERS OF TEACHING STAFFS AT UNIVERSITY DEPARTMENTS OF AGRICULTURE, AGRICULTURAL COLLEGES, ETC., IN ENGLAND AND WALES.

School of Agriculture, University of Cambridge.

The following is the revised list of the Teaching Staff, as given in the *Handbook* to the School, just published by the Cambridge University Press, price 2s. 6d. :—

Agriculture

Drapers' Professor	..	..	F. L. ENGLENDOW, M.A. (Director of Advanced Students).
Lecturer	..	..	W. S. MANSFIELD, M.A. (Director of the University Farm).
Demonstrator	..	..	W. K. HUBBLE, B.A. (Assistant Demonstrator at the University Farm).

Agricultural Botany

Professor	..	..	Sir R. H. BIFFEN, M.A., F.R.S.
Lecturer	..	..	J. LINE, M.A.

Plant Diseases

Lecturer	F. T. BROOKS, M.A.
----------	----	----	--------------------

Animal Pathology

Professor	J. B. BUXTON, M.A., F.R.C.V.S., D.V.H.
-----------	----	----	--

Animal Husbandry

Lecturer	F. H. GARNER, M.A.
----------	----	----	--------------------

Crop Husbandry

Lecturer	H. G. SANDERS, M.A., Ph.D.
----------	----	----	----------------------------

Agricultural Physiology

Reader	F. H. A. MARSHALL, ScD., F.R.S.
--------	----	----	---------------------------------

Agricultural Biology

Demonstrator	A. WALTON, Ph.D.
--------------	----	----	------------------

Agricultural Chemistry

Lecturer	H. E. WOODMAN, M.A., D.Sc.
----------	----	----	----------------------------

Agricultural History and Economics

Lecturer	J. A. VENN, Litt.D.
----------	----	----	---------------------

Estate Management

Lecturer	..	..	E. P. WELLER, M.A., F.S.I., F.L.A.S.
Demonstrator	..	..	N. DEAN, M.A., F.S.I., M.R.San.I.

Agricultural Analysis

Demonstrator	L. F. NEWMAN, M.A., F.I.C.
--------------	----	----	----------------------------

Statistics

Lecturer	G. UDNEY YULE, C.B.E., M.A., F.R.S.
----------	----	----	-------------------------------------

Physics and Engineering

Lecturer	J. E. FEW, M.A., LL.B.
----------	----	----	------------------------

Economic Entomology

Lecturer C. WARBURTON, M.A.

*Veterinary Science*Lecturer Col. W. A. WOOD, C.B.E., M.A.,
M.R.C.V.S.

* * * * *

Enforcement of Minimum Rates of Wages.—During the month ending September 14, legal proceedings were instituted against nine employers for failure to pay the minimum rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases are as follows :—

County.	Court	Fines			Costs			Arrears of wages			No. of workers involved
		£	s.	d.	£	s.	d.	£	s.	d.	
Chester ..	Chester ..	1	0	0	—	—	—	13	13	6	1
Cumberland	Wigton ..	*	—	—	0	14	0	25	8	0	1
Devon ..	Axminster ..	5	0	0†	—	—	—	55	0	0	3
Gloucester.	Gloucester ..	1	10	0	1	9	0	45	0	8	3
„	Newnham-on Severn	1	0	0	0	18	6	3	10	3	1
Monmouth.	Pontypool ..	2	0	0	—	—	—	0	13	10	1
Norfolk ..	East Dereham	0	15	0	—	—	—	7	4	6	3
Denbigh ..	Ruthin ..	*	—	—	1	12	0	10	0	0	1
Radnor ..	Talgarth ..	3	0	0	—	—	—	10	0	0	1
		£14	5	0	£4	13	6	£170	10	9	15

* Dismissed under Probation of Offenders Act.

† Including costs.

* * * * *

Foot-and-Mouth Disease.—An outbreak was confirmed on September 6 at Holbeck, Leeds, Yorkshire, West Riding, and two further cases were confirmed on the following day in the same locality. These are the first cases to occur in Great Britain since the outbreak at Goring-on-Sea, Worthing, West Sussex, confirmed on December 23, 1929; that is, after a period of more than eight months' complete freedom from the disease. On September 15, two outbreaks were also confirmed at Pirbright, Surrey. On September 20, a new centre of disease was discovered at Beesdale, Stokesley, Yorks (N.R.). The usual restrictions were applied to an area of approximately fifteen miles round the infected premises at each centre of disease.

* * * * *

NOTICES OF BOOKS

Rothamsted Memoirs on Agricultural Science. Pp. 905. Royal 8vo, half-calf. (Published at the Rothamsted Experimental Station, Harpenden, Herts. Price 36s. net. Inland post free; Foreign post extra.)

This volume, which includes 64 memoirs, covering the period from 1928 to 1930, is now ready for distribution, and copies can be obtained on application to the Secretary of the Station, as above. It is requested that orders for the work should, as far as possible, be accompanied by remittances and, as the edition is strictly limited, early application is advisable.

International Directory of Pedigree Stock Breeders, Vol. III, 1930-31. Pp. 1100. (London: The Vernon Press, Ltd. Price 30s. net.)

This, the third and revised edition of the Directory, contains alphabetical lists of the names, with addresses, of some 120,000 breeders of

all classes of pedigree live stock in all parts of the world. The book, which is well illustrated, contains interesting information upon live stock breeding in the different countries, and descriptions of the various breeds of stock, together with articles on general topics connected with breeding. Among other features of this edition is a new section giving the names of breeders of thoroughbred horses in Great Britain and Ireland and some 20 other countries in which the breeding of blood stock is prominent.

Pests in Wheat and its Products.—By Sebert Humphries. Pp. 36. Technical Education Series Pamphlet No. 5 (The National Joint Industrial Council for the Flour Milling Industry, 26-28 King's Road, Chelsea, London, S.W. 3. Price 6d. net.)

This pamphlet is divided into two parts, the first of which deals with the "Suppression of Pests" and the second with the "Pests Themselves." The long struggle against the pests which flourished in the large bulk of wheat, stored in Australia for the Royal Commission on Wheat Supplies, during the latter years of the war and just after, is fully described; and from that point of departure a description of the various modern methods of combating the pests is fully entered into. The second part gives a brief entomological description of the pests divided into four sections, i.e., Beetles (which include Weevils), Moths, Worms and Mites, and is concluded by a few notes on the parasites of pests.

Heredity in Livestock. By Christian Wriedt. Pp. xi+179. Illustrated. (London: Macmillan and Company, Limited. 1930. Price 7s. 6d. net.)

It would have been impossible for any man of science writing on heredity with the purpose of making that science useful to the breeder to have avoided some reference to the work of the great breeders of the eighteenth century, because it is upon their work that much of modern practice is based. The consideration of these men's work by Christian Wriedt is a guarantee of Professor Punnett's statement, in his foreword to the book, that Wriedt acted the part, as was his ambition, of a liaison officer between men of science and practical breeders. The book makes available, in simple and non-technical language, the findings of modern science in heredity. The author critically examines a great many experiments, and explains their application to the problems of mating farm animals so as to obtain the best economic results.

The book opens with a discussion of the Mendelian law of heredity and goes on to a discussion of the factors influencing the inheritance of size, capacity for milk production, the butter fat content of milk, etc. The vexed question of in-breeding is fully treated in three chapters devoted to cattle, horses and pigs, sheep and poultry, and other points at issue are also dealt with, the final chapter on superstitions disposing of some amusing ideas and providing a little light relief. There can, of course, be no question of Wriedt's contribution to the subject and his book should be of great service to breeders who wish to bring their knowledge of the subject up to date.

Further Illustrations of British Plants. By R. W. Butcher: drawings by F. E. Strudwick. Pp. 476. L. Reeve & Co., Ltd., Ashford, Kent, 1930. Price 12s.

This well prepared volume forms a supplement to Bentham's *Hand-book of the British Flora*, which has passed into a seventh edition (1924). It contains black and white figures, with dissections, of 485 British plants, the vast majority of which are not represented in

Fitch's *Illustrations of the British Flora*, fifth edition (1924), and are not available in any other single volume dealing with British plants. A brief description accompanies each plate and gives the essential specific characters. The choice of species for figuring within a single volume of limited size seems to have been well made and the drawings are, with few exceptions, excellent as a means to identifying those more critical species which were not recognized or taken up by Bentham. The author and his artist are both to be congratulated on producing a most useful work, which should stimulate interest in the detailed study of our varied flora.

The Pig Breeders' Annual for 1930-31 and Year Book of the National Pig Breeders' Association.—Pp. 148. (Published by the Association, 92 Gower Street, London, W.C.1. Price 2s. 6d. net.)

The present volume completes a decade of the life of this Annual, and its contents are as varied and interesting to the breeder as they have been in the past. Lord Noel-Buxton contributes a foreword to this issue, which contains a great deal of useful information on feeding and on the industry in some foreign countries and in New Zealand. Amongst others an article by David Black on "The Future of Co-operative Bacon Factories in England" is worthy of mention. Diseases and their treatment are also dealt with, and some of the general aspects of the industry in their commercial relations are also covered, while an interesting article on its history and development is contributed by Dr. A. G. Ruston, under the title of "Pig Keeping, Ancient and Modern." The number and variety of the articles contained in this issue prohibits anything like a complete indication of the contents, but readers of this JOURNAL will, no doubt, already be familiar with the general character of the Annual, and, if they are engaged in pig breeding, satisfied that it should prove useful to them.

The English Plough. By J. B. Passmore, M.Sc. Pp. 84. Illustrated. Reading Univ. Studies. (London: Oxford University Press. Humphrey Milford, 1930. Price 7s. 6d. net.)

This is an outline of the history of the development of the English plough, written by the lecturer in agricultural engineering at Reading University, and is the first special study of the subject which has appeared. There are histories of the plough in general, and it has, of course, been treated of in all the general histories of English farming; but this brief monograph should be useful to the student of agricultural engineering because it provides an historical background to his studies of the modern technique of plough manufacture and the practical use of the implement. The book is divided into four sections, dealing with the "Development of the English Plough," "Descriptions of Ploughs," "Construction of Ploughs," and "One-Way Ploughs." Only the main types of improvement are dealt with and there is no mention of any but the single furrow plough, while the only writers on plough design of the 18th century who are mentioned are Arbutnot and Small. It is to be regretted that the references are usually incomplete, lacking volume and page numbers; nor is the author adequately equipped to deal with the historical development of the plough. But few of his readers are likely to seek for guidance on historical questions. For students of modern agriculture these will be minor deficiencies and the book will undoubtedly serve a useful purpose.

The Transactions of the Yorkshire Agricultural Society for the Year 1929, No. 87. Edited by the Secretary to the Society. Pp. 132, 12, 47. Illustrated. (York: Published and sold only by the Society at New Street Chambers. Price 5s.)

This Annual contains some twenty items and it is only possible to note a few of them. Several of the contributors are, however, well

known to readers of this JOURNAL and are acknowledged authorities on the subjects upon which they write. Professor Hanley deals with "The Formation of New Pastures," Professor Gaiger with "Grass Disease," and Dr. Crowther, with "Feeding the Bacon Pig." Other interesting contributions are those by Sir Alfred E. Pease, Bart., on "Blackface Sheep, their Origin and History," J. K. Thompson on "Dried Sugar Beet Pulp—its Value and Use," and R. McG. Carslaw on "The Effect of Size and Shape of Fields on Costs and Profits." The other items are also of interest, and from Appendix B it is learnt that this flourishing Society has a membership of some 3,562.

A Survey of Milk Marketing in Derbyshire, June, 1928. By F. J. Prewett. Pp. 70. (London: Humphrey Milford, Oxford University Press. 1930. Price 2s. 6d. net.)

The author of the present survey has given us two earlier works on the subject, one of which is *The Marketing of Farm Produce: Vol. II., Milk* (1927), and the other *A Survey of Milk Marketing, based on conditions in Wiltshire and Somerset and the City of Bristol, June, 1927* (1928). The latter deals with an area which is mainly dependent on distant markets, and includes cheese-making as a feature of its dairying industry. The work under notice refers to a more industrialized county, surrounded by large towns, where the main activity of dairy farming is centred on milk selling. It may, perhaps, be added that Derby was always largely a grazing county, but that, before the era of railway transport, local sales of milk prevailed, while butter and cheese, less perishable and more valuable in relation to bulk, were exported from the county.

After a careful survey of the conditions of marketing of milk in Derbyshire, Mr. Prewett comes to the conclusion, *inter alia*, that, with such a diversity of marketing methods in the county, competition among producers for a liquid market is inevitable. The producer, he suggests, must, therefore, organize on some basis that will give him power over the methods of distribution and the right to insist upon information as to the quantities relatively distributed, liquid and manufactured. For this purpose he indicates that the organization known as the "Pool" would be effective.

Such surveys as this of Mr. Prewett's and his earlier work are useful in so far as they describe the position of a branch of the farming industry in a particular place at a point of time. In order to give full consideration to the situation in the country, and, if necessary, to the possibility of its improvement, they need, however, to be correlated with a general survey, which is not always available, but which, in the case of fluid milk, has been provided by Mr. R. B. Forrester in *The Fluid Milk Market in England and Wales* (The Ministry's Economic Series No. 16).

It may, perhaps, also be suggested that the provision of a slight historical introduction would be an advantage in showing how modern conditions have arisen, and that it would not be necessary for this purpose to go further back than the County Reports of the old Board of Agriculture which were issued about the end of the eighteenth century, and to supplement these by the prize essays on different counties to be found in the Journal of the Royal Agricultural Society.

The History of the Corn Laws, 1660-1846. By Donald Grove Barnes. Pp. xv. + 336. (London: George Routledge and Sons, Limited. 1930. Price 15s. net.)

A comprehensive history of the English corn laws has long been a desideratum for students of economic history; and besides the history of the legislation a study of the repercussions of the laws upon the

production and trade in wheat and the other cereals would have been an additional advantage. Professor Barnes has confined himself almost exclusively to the laws and the pamphlet literature of the controversies that preceded and followed them, a sufficiently arduous and comprehensive piece of work perhaps, and one that forms a very welcome addition to the sum of historical knowledge. It is, indeed, almost impossible to define the effect of the eighteenth century laws upon the farming industry, because many of them did not effectively carry out the aims for which they were formulated; moreover, the industry and the trade in its products were subject to many other, possibly more potent, influences than those of the legislation, and these are so closely interrelated that they cannot be separated and estimated individually.

The most important of these influences were the inclosure and redistribution of a proportion of the land farmed under the open field system, and the inclosure of some of the waste, which affected the area under cereals and the yield obtained from this area, thus providing an exportable surplus or increasing the supply sufficiently to enable the requirements of a growing population to be met without undue dependence upon importation until well into the nineteenth century. For his discussion of this factor Professor Barnes is, however, content to depend upon secondary authorities, and this is comprehensible in the light of the aims and scope of the book.

By most of the modern writers on the different phases of agrarian economy in the eighteenth century the year 1765 has been taken as a dividing point between the period of exportation and that of importation of cereal foodstuffs. By some, the earlier period has been regarded as the golden age of British agriculture, particularly for the wheat grower. Professor Barnes thinks that this view may reasonably be regarded as exaggerated, and equally that the effects of agricultural improvements on the production and exportation of grain during that time may be over estimated. It is true that the effect of these improvements was slight before 1760 and only fully developed in the nineteenth century. Professor Barnes does not, however, fail to apply the epithet "vast" to the improvements he thinks may be easily exaggerated. "The first half of the eighteenth century," he says, "is well known for its improvement in stock breeding, rotation of crops, manuring and draining. Much of the advance must be ascribed to pioneers in these fields." It must, however, be remembered that Young himself said in the *Annals* for 1784 (p. 95) that the improved farming of Norfolk, Suffolk and Kent was confined to very narrow limits.

A surplus of grain, above the requirements of the localities in which it was grown, had indeed been secured in the seventeenth century, and that was, as Professor Barnes admits, one of the reasons for the passing of the Act of 1689. It is probable that this Act had some effect in stimulating the growth of grain between 1689 and 1765, but it is doubtful if the law was more important than the more rapid growth of population, which affected the development of cereal cultivation so much more markedly in the last decades of the century and in the first four of the nineteenth. Other elements also played their part in determining to what uses the soil should be put, and not the least of these was its own suitability for grain or grazing, a fundamental quality that no intelligent farming community can ever fail to overlook.

Professor Barnes has definitely confined himself to the corn laws after 1660, the era previous to that date being disposed of in a single brief chapter, and this is doubtless because the modern period is one that involved external as well as internal trade, and the laws in the main aimed at the regulation of the foreign trade, with the idea of maintaining

the home supply at a sufficient level. The extraordinarily comprehensive bibliography shows how thoroughly the work has been done, and the book takes its place as the most comprehensive study of the subject which we yet possess.

Animal Breeding. By Laurence M. Winters. Pp. x. + 389. Illus. (New York, John Wiley & Sons, Inc. London, Chapman & Hall, Ltd. 1930. Price 18s. 6d. net.)

This, the second edition of Professor Winters' book, has been rewritten. Its author is Animal Breeder and Associate Professor of Animal Husbandry in the University of Minnesota, and in this edition he has endeavoured to make the text more comprehensive, to correct any errors there may have been in the first edition, and to include much of the recently published work relating to the rapidly extending subject of animal breeding.

As he says, animal husbandry is the foundation of successful agriculture; and animal breeding is the beginning of all animal husbandry. It is, therefore, one of the most important agricultural subjects. Moreover, the population of the world is increasing rapidly and a much larger supply of food will be required within an appreciable length of time. Although the *per capita* consumption of animal products in some countries may diminish, the total quantity used in the world will increase tremendously. Animal husbandry is thus a matter of vast importance not only from the point of view of the farmer, but also to the world at large.

The practice of animal breeding is very old, but the science upon which it rests is very young. Consequently each of the past few years has produced valuable contributions to the subject, and the author has made it his object to select those contributions, whether old or new, that seem most valuable, and to incorporate them in his book. The fourteen pages of closely printed bibliography at the end of the book show how widely his net has been cast, and how easy will be the task of those who wish to use this book as a preliminary to pursuing the subject further.

As might be expected, the book has been prepared primarily for use as a text book for students at agricultural colleges and by their teachers. Professor Winters admits that the arrangement of the text will not satisfy all requirements, because the science of animal breeding is taught differently at different institutions, but he has endeavoured to embody the numerous valuable suggestions he has obtained from teachers who have been using the first edition of his book. It is perhaps unnecessary here to set out the contents in detail because they are sufficiently indicated by the title, but it will be enough to say that the arrangement of the main body of the work is in four parts—I. The Foundation, economic and biological; II. Reproduction; III. Heredity; and IV. The Practice—so that it covers the whole range of the subject.

Sugar Beet : Costs and Returns for the Year 1928-29. By A. Bridges and J. R. Lee. Pp. 50. (Oxford Agricultural Economics Research Institute, 1930. Price 1s.)

This pamphlet continues the series which has now been issued annually for some years, and presents further results of the Institute's inquiry into the financial and economic aspects of the beet sugar crop. The form in which the returns are presented may now, in the fifth year of the accumulation of these records, be regarded as stabilized, the dual classification of the costs, by soil groups and geographical areas, having been continuously adhered to. This procedure facilitates the comparison of the results year by year and renders the returns the more valuable.

The summary shows that while the area of beet and number of growers declined in 1928 as compared with 1927, the year was more favourable to the crop, and both yield and sugar content were greater than in the previous year. In neither year, however, were the factories working at full capacity.

Progress in English Farming Systems—II. The Improvement of Upland Grazings. By Stanley M. Bligh and F. J. Prewett. Pp. 36. (London: Humphrey Milford, Oxford University Press. 1930. Price 1s. 6d. net.)

Mountainous country is, of necessity, where it can be used at all, usually devoted to grazing, and Wales has always depended more upon its sheep and cattle breeding than upon any other branch of farming to supply its saleable products. Much of its grazing land has always been in a state of nature, but this small study definitely shows that a proportion of it at least is not unimprovable. Mr. Bligh himself, the landowner who is responsible for the work done on his estate near Builth Wells, estimates this proportion at between one million and a million and a-half acres in the Principality—or nearly one-half of the total of 3,100,000 acres of rough grazings and permanent grass not kept up for hay, which constitute three-fifths of the area of Wales. He also suggests that a further million acres of similar land in the West of England could be improved in the same way. Such optimism deserves careful consideration, especially when it is supported by the evidence of the very effective work Mr. Bligh has done on his own estate. His conditions, however, are peculiar, and it is doubtful if the system could be generally applied. For example, there is apparently a local demand for accommodation land, and family labour is the basis of the system. The system that Mr. Bligh has adopted so successfully is, of course, fully described in the booklet, and both occupiers and owners of land of this character should consider it carefully when they are about to attempt the improvement of this class of holding.

Progress in English Farming Systems—III. A Specialist in Arable Farming. By C. S. Orwin. Pp. 24. (London: Humphrey Milford, Oxford University Press, 1930. Price, 1s. 6d. net.)

This little book, scarcely more than an essay, deals with the life story of the farmer of the largest arable acreage in England, and sets out to show that the application of the results of scientific investigation to the practical problems of farming have resulted in what can only be described as a magnificent success. Mr. Orwin describes how Mr. Baylis purchased Wyfield Manor in 1875 with £15,000 of borrowed money, and how from that apparently inauspicious beginning he has built up holdings until he now farms an area of some 12,000 acres in the counties of Berkshire and Hampshire. Mr. Baylis, explains Mr. Orwin, set out to cultivate arable land for the purpose of selling off all the products, including the straw and hay, and for this reason dispensed with all live stock except the horses necessary for the farm work. His rotation was corn, fallow, corn, clover, corn, fallow, and fertility was maintained by the liberal application of artificials. It is interesting to note that while steam tackle is hired for ploughing on Mr. Baylis' many farms, he has not yet adopted the use of the tractor, all his other work being done by a large number of horses.

The Seasonal Distribution of Farm Labour Requirements. By W. H. Kirkpatrick, C.D.A. (Glas.), Dip. Agric. Econ. (Cantab.). Univ. of Cambridge; Farm Economics Branch. Report No. 14. Pp. iv + 44. (Cambridge: W. Heffer & Sons, Ltd. 1930. Price, 2s. net.)

In presenting a study of the labour requirements over a period of two years on a number of sample farms in the Eastern Counties, the writer emphasizes the fact that labour costs form an increasingly large propor-

tion of the total costs of the farm. He estimates that labour is roughly twice as expensive to-day as in pre-war years, while the farmer's produce is fetching less than one and a-half times as much. Even allowing for an increased production per worker, the incidence of the higher cost of labour bears heavily on the industry. It is unlikely that this state of affairs will be remedied by the reduction of wages (which in any case would be undesirable) and consequently the difficulty must be dealt with by the more efficient organization of labour and a consequently enhanced output per unit. It is with the object of assisting in such organization that this study has been published. The author has had access to the labour records for the two years 1927 and 1928 of twelve fully-costed farms distributed throughout the counties of Cambridge, Essex, Hertford, Huntingdon, Norfolk and Suffolk, and this sample, representing twenty-four farming years, has been found to be generally statistically representative of the normal conditions in the Eastern Counties.

The distribution of labour, both manual and horse, is analysed very closely and is illustrated with a number of graphs and tables, the results being fully discussed. The author admits that his conclusions can only be regarded as tentative and that there are many other problems of an allied nature which need to be investigated before final conclusions of a practical character can be formulated which will enable the farmer to organize his labour so that it will be employed on profitable work to the maximum throughout the year. This report, however, represents a beginning, and a promise of a fuller consideration of the organization of agricultural labour in the Eastern Counties is made for the future. This will no doubt come to hand when a much larger body of data has been collected and examined.

The Weather Map: An Introduction to Modern Meteorology. Second Edition, entirely re-written. The Air Ministry Meteorological Office. Pp. iv+83. Illustrated. (London: H.M. Stationery Office. Price, 3s. net.)

The first issue of this publication appeared in 1915 and frequent reprints have been necessary since that date, the sixth being issued in 1925. The book has now been entirely re-written to meet the great advance made in synoptic meteorology of recent years.

As an introduction to the subject, an outline is given of the history of weather maps, which commenced with the end of the seventeenth century. Then follows a description of the various observations from which weather maps are prepared—temperature, pressure, wind force and direction, cloud types and height, visibility, etc. The weather generally associated with the different pressure systems is described, and the method of preparing forecasts is indicated.

As a practical illustration, twelve examples of forecasts are appended with copies of the weather maps upon which they were based, and notes indicating the reasons which led the forecaster to his decision.

Factors Affecting the Price of Potatoes in Great Britain. By Ruth L. Cohen, B.A. Univ. of Cambridge: Farm Economics Branch Report No. 15, pp. 55. (Cambridge: W. Heffer & Sons, Ltd. 1930. Price 2s. 6d. net.)

The growers have for some years found great difficulty in dealing with the sale of their crops of potatoes so as to obtain an adequate price covering their costs and providing an element of profit. The main cause of this has been assumed to be the fluctuation in yield to which this crop is specially liable, and the difficulty has been the more pronounced when the harvest has been so good as to make it almost impossible to sell the stocks at any price at all. This study of the factors affecting the price is the more welcome on this account.

After a careful consideration of the retail and wholesale prices of potatoes, and the conditions of the crop and its sale from the earliest time when the essential figures are available, Miss Cohen summarizes her conclusions and states that "The analysis thus indicates that little can be done to alter variations in supply, so long as fluctuations in yield continue. For such movements are not sufficiently regular for it to be possible to advise farmers to alter their acreage in the opposite direction to variations in yield."

"The farmer would gain if prices were rendered more steady intraseasonally. It has been shown that, in general, farmers and dealers seem to be unwilling to recognize that production is either unusually high or unusually low. Hence prices do not rise for some time when production is small, or fall for some time when it is large. This tendency is more marked for a deficiency than for a surplus of production. So, in years when home production is low, imports enter the country in the later months of the crop year, and foreign producers get the benefit of the high prices in these months, while the English farmers sell the bulk of their crops at the lower prices prevailing earlier in the year. This tendency to miscalculation, though still in evidence, has recently become less pronounced. Its elimination, by the spread of information, would almost certainly benefit the British farmer."

Dairy Cattle : Selection, Feeding, Management. By William Wodin Yapp, Ph.D., and William Barbour Nevens, Ph.D. Illustrated, pp. xix+390. (New York : John Wiley & Sons, Inc. ; London : Chapman & Hall, Ltd. 1930. Price 12s. 6d. net.)

The authors of this work are respectively Professor of Dairy Cattle and Associate Professor of Dairy Cattle Feeding in the Illinois College of Agriculture. The first edition was planned with the aim of making available to students of dairy farming and to dairy farmers themselves the most practical methods of selecting, feeding, and caring for dairy cattle. The methods recommended in the book were based upon the proved and tested practice of successful dairymen in the United States of America and upon the results of scientific investigation. The style is simple and concise, and the student and farmer can secure accurate information without an extensive search through scientific literature. The second edition has become necessary because of the more recent developments in the fields of animal breeding, nutrition, and physiology, which, it is claimed, are now incorporated.

As in all American books, forage crops which are not extensively cultivated in Great Britain are strongly recommended for the reason that they form the basis of successful dairy farming in the United States. Apart, however, from this, the work contains many features of use to students and dairy farmers in this country.

Wheat. By W. W. Swanson, Ph.D., and P. C. Armstrong. Pp. xiii+320. (Toronto : The Macmillan Co. of Canada, Ltd. 1920. Price 12s. 6d. net.)

This study of the conditions of wheat growing and marketing in Western Canada is written by the Professor of Economics of the University of Saskatchewan and a Consulting Agriculturist. It is a definite contribution to our knowledge of wheat production, and similar studies relating to the other great centres of cultivation would do much to elucidate many points now the subject of constant discussion. Methods of wheat cultivation and sale are of world-wide importance and can no longer be dealt with parochially, or according to the ideas of limited areas of demand and supply.

The one crop system of farming in Western Canada is very different from any type of agriculture practised in this country, and therefore

the book has little to teach us technically on this side. Moreover the making of a farm area from the wilderness in a brief space of time has caused a development in the community inhabiting the wheat belt different from anything that can be found in the older, more slowly created communities of Europe, where the present position has been arrived at only after the slow evolution of centuries.

The methods of handling the crop in Canada are fully described and the development of co-operative wheat marketing is traced. The rapid development after 1923, following on more isolated attempts at the co-operative ownership of elevators and of selling, is largely attributed to the strong community spirit in Western Canada and to the fact that inspection and handling have been developed to mechanical perfection. In the chapter on the wheat pools, the writers support the pool's claims to having benefited farmers and rendered marketing more efficient. But they, in looking to the future, see two dangers to the pool movement: the danger of pools becoming influenced by politics and of the agitations for compulsory pooling threatening the success of a voluntary organization. But the arguments for and against the compulsion of minorities are not treated in sufficient detail to convince the reader.

The lesson to be learned from Canadian conditions is one of marketing difficulties and how they have been tackled. From time to time notes have appeared in this JOURNAL about the Wheat Pool, and it is possible that some organization of this kind might be of service to British agriculture. It should be remembered, however, that the Canadian, no less than the British, farmer desires to raise the farm price of his produce and that he also is faced with the fact that wheat is ruled by a world price. Moreover the Canadian farmer is in rather a better position to sell advantageously because the major portion of his crop is grown from one type of seed and is, therefore, the more readily graded.

This readable book should prove valuable to the general reader.

SELECTED CONTENTS OF PERIODICALS

(List concluded from the JOURNAL for September, 1930.)

Dairying and Dairy Products

The Inheritance of Milk Yield in Ayrshire Cows. *A. D. Buchanan Smith, R. J. Scott and A. B. Fowler.* (Jour. Dairy Res., i, 2 (May, 1930), pp. 174-179.) [575.1; 63.711.]

The Analysis of the Lactation Curve into Maximum Yield and Persistency. *H. G. Sanders.* (Jour. Agric. Sci., xx, 2 (April, 1930), 145-185.) [612.664; 63.711.]

Milking at Three Eight-hour Intervals as a Means of Investigating Variations in the Fat and Solids-not-Fat. *K. W. D. Campbell.* (Jour. Agric. Sci., xx, 2 (April, 1930), pp. 213-232.) [63.711; 63.712.]

Bacteriological Examination of Milk for Local Authorities in Wales. *P. M. Hickson and S. B. Thomas.* (Welsh Jour. Agric., Vol. vi (1930), pp. 265-278.) [576.8:7; 614.32; 63.712.]

Laboratory Work in connection with Butter Competitions. *S. B. Thomas.* (Welsh Jour. Agric., Vol. vi (1930), pp. 279-284.) [576.8:7; 614.32; 63.721; 63.726.]

A Preliminary Report on the Bacteriological Examination of Fresh Cream and Artificial (Reconstituted) Cream. *S. B. Thomas.* (Welsh Jour. Agric., Vol. vi (1930), pp. 284-289.) [576.8:7; 614.32; 63.712.]

Methods of Determining the Numbers of Bacteria in Milk. *A. T. R. Mattick.* (Jour. Dairy Res. i, 2 (May, 1930), pp. 111-135.) [576.8 : 7.]

Rusty Spot in Cheddar and other Cheese. II.: Factors Controlling the Pigmentation of the Causative Organism. *J. G. Davis and A. T. R. Mattick.* (Jour. Dairy Res. i, 2 (May, 1930), pp. 136-148.) [63.735.]

Pasteurized Milk for Cheddar Cheese-making. I.: A Preliminary Chemical Investigation. *G. M. Moir.* (Jour. Dairy Res. i, 2 (May, 1930), pp. 149-167.) [63.73 : 63.736.]

The Comparative Trend of Prices of British and Imported Dairy Products. *R. H. Wynne.* (Welsh Jour. Agric., Vol. vi (1930), 109-116.) [63.723 : 63.732.]

Poultry

The Maintenance Requirement of the Fattening Cockerel with a Note on a Proposed New Method for the Determination of the Surface Area of Birds. *B. A. Southgate.* (Jour. Agric. Sci., xx, 2 (April, 1930), pp. 206-212.) [612.394 : 63.651 : 043.]

A Comparison of Shrimp "Bran" and Two Kinds of Fish Meal when fed at a Level of Ten per cent. in Diets for Growing Chicks. *H. W. Titus, E. McNally and F. C. Hilberg.* (Poultry Sci., ix, 4 (May 1, 1930), pp. 219-234.) [612.394 : 63.60432 : 63.651 : 043.]

Veterinary Science

Experiments on the Treatment of Parasitic Gastritis in Sheep and Lambs. *W. A. Wood.* (Jour. Agric. Sci., xx, 2 (April, 1930), pp. 186-205.) [59.169 : 619.3.]

A Review of Undulant Fever. *J. Mills.* (Jour. Dairy Res., i, 2 (May, 1930), pp. 180-184.) [619 : 619.2.]

Immunization of Fowls against Fowl Pox by Means of Pigeon Pox Virus. *T. M. Doyle.* (Jour. Comp. Path. and Ther., XLIII, pp. 40-55 (March, 1930).) [619.5.]

Report on Ox Warble Flies and their Control. *R. C. Gaut and C. L. Walton.* (Ann. Rept. Long Ashton Agric. and Hort. Res. Stn., 1929, pp. 220-225.) [619.2.]

ADDITIONS TO THE LIBRARY

Agriculture, General and Miscellaneous

Garratt, G. T.—The Organization of Farming. Vol. I. Production. (163 pp.) Cambridge: Heffer, 1930, 6s. [63 (42) : 63 (022) : 63.191.]

University of Oxford, Agricultural Economics Research Institute.—Progress in English Farming Systems. II. The Improvement of Upland Grazings, by *Stanley M. Bligh and F. J. Prewett.* (36 pp.) Oxford at the Clarendon Press; London: Humphrey Milford, 1930, 1s. 6d. [63.33 : 63.33-16.]

University of Oxford, Agricultural Economics Research Institute.—Progress in English Farming Systems. III. A Specialist in Arable Farming, by *C. S. Orwin.* (24 pp.+2 pl.) Oxford at the Clarendon Press; London: Humphrey Milford, 1930, 1s. 6d. [63.191 : 63.192.]

Barnes, D. G.—A History of the English Corn Laws from 1660-1846. (336 pp.) London: Routledge & Sons, 1930, 15s. [33 : 337 (42) : 63 (09).]

Williamson, H.—The Village Book. (342 pp.) London: Cape, 1930, 7s. 6d. [30.]

Heather—Hay—Houses—Health. With a chapter by *Dr. Bernard Dyer* on chemical manures suitable for cultivated heath. (168 pp.) Obtainable from Mr. W. Webb, Moorside, Ashley Heath, Nr. Ringwood, Hants. 1929, 2s. [63.12; 63.19.]

[A description of Land Reclamation carried out during the past eight years near the New Forest.]

Jones, W. H.—A Survey of the Agricultural and Economic Conditions of a Parish in Carmarthenshire. (27 pp.) (Reprinted from the Welsh Housing and Development Year Book, 1930.) Cardiff: The Welsh Housing and Development Association, 38 Charles Street, 1930, 6d. [338.1 (429).]

Passmore, J. B.—The English Plough. (84 pp.+13 plates.) Oxford University Press. London: Humphrey Milford, 1930, 7s. 6d. [63.17.]

Union of South Africa, Department of Agriculture.—Handbook for Farmers in South Africa. (Second Edition. Revised.) (766+vii pp.+12 plates.) Pretoria: Government Printer, 1929. 5s. [63 (68); 63 (022).]

Tempany, H. A., and Mann, G. E.—Principles of Tropical Agriculture. (328+xxiii pp.+5 plates.) Kuala Lumpur, Malaya: The Incorporated Society of Planters, 1930. [63 (024).]

Empire Marketing Board.—E.M.B. No. 31: The Production of Tung Oil in the Empire. (20 pp.+10 plates.) London: H.M. Stationery Office, 1930, 1s. [63.342.]

Empire Marketing Board.—E.M.B. No. 27: Cocoa—World Production and Trade. (97 pp.) London: H.M. Stationery Office, 1930, 1s. [63.3462.]

Empire Marketing Board.—E.M.B. No. 26: British Industries and Empire Markets, by *A. J. Sargent*. (58 pp.) London: H.M. Stationery Office, 1930, 1s. [338; 382.]

Walker, A. H.—The Inspection of Fish, Poultry, Game, Fruit, Nuts and Vegetables. (Second Edition.) (xii+253 pp.) London: Baillière, Tindall and Cox, 1930, 12s. 6d. [614.3; 614.32; 614.33.]

Malcolm, O. P.—Successful Canning and Preserving. (Fourth Edition.) (663 pp.+5 plates.) Philadelphia and London: J. B. Lippincott Co., 1930, 12s. 6d. [664.84; 664.85; 664.9.]

National Joint Industrial Council for the Flour Milling Industry.—Technical Education Series, Pamphlet No. 6: The Roller Mill as used in the Milling of Wheat Flour, by *J. R. Birch*. (66 pp.) London: 26-28 King's Road, Chelsea, 1930, 6d. [664.6.]

United States Department of Agriculture.—Farmers' Bulletin No. 825: Pit Silos. (8 pp.) (Revised.) Washington, 1930. [694.]

Fisher, R. A.—Statistical Methods for Research Workers. (Third Edition.) (283 pp.) Edinburgh and London: Oliver and Boyd, 1930, 15s. [311.]

Irish Free State Department of Industry and Commerce.—The Agricultural Output of Saorstát Éireann, 1926-27. (52 pp.) Dublin: Stationery Office, 1930, 9d. [31 (415).]

Agricultural Economics

South-Eastern Agricultural College, Wye.—Department of Economics, Report No. VIII. Investigation into Farming Costs of Production and Financial Results. General Report on Six Years' Results by *J. Wyllie*. (pp. 213-288.) Wye, 1930, 2s. 6d. [338.1 (42).]

University of Cambridge, Department of Agriculture.—Farm Economics Branch, Report No. 14: The Seasonal Distribution

- of Farm Labour Requirements, by *W. H. Kirkpatrick*. (44 pp.) Cambridge: Heffer, 1930, 2s. [331 (42); 338.1 (42); 63.19.]
University of Cambridge, Department of Agriculture.—Farm Economics Branch, Report No. 15: Factors Affecting the Price of Potatoes in Great Britain, by *Ruth L. Cohen*. (55 pp.) Cambridge: Heffer, 1930, 2s. 6d. [63.512 : 31.]
Laur, E.—*Economie Rurale de la Petite et Moyenne Culture*. (Deuxième Edition.) (470 pp.) Lausanne: Librairie Payot et Cie, 1929, 8 Fr. [338.1 ; 63 (022).]
Acerbo, Giacomo.—*Storia ed Ordinamento del Credito Agrario nei Diversi Paesi*. (635 pp.) Piacenza, 1929, 50 Lire. [332.71.]

Co-operation

- The Co-operative Union, Ltd.*—Agricultural Advisory Series No. 5: Modern Meat Problems. An up-to-date survey of co-operative meat trade problems and possibilities, by *G. Walworth*. (19 pp.) Manchester, 1930, 3d. [63.75.]
The Co-operative Union, Ltd.—Agricultural Advisory Series No. 6: The Organization of a Co-operative Milk Service. A pamphlet prepared to the order of the United Board for use of Co-operative Conferences as a means of developing Co-operative Service in Milk, by *G. Walworth*, foreword by *G. Major*. (18 pp.) Manchester, 1929, 3d. [334 ; 63.716.]
United States Department of Agriculture.—Department Bulletin No. 1106: Legal Phases of Co-operative Associations. (126 pp.) (Revised.) Washington, 1929. [334 (73); 334.]
International Labour Office.—International Labour Directory. Part VI. Co-operative Organizations. (224 pp.) Geneva, 1929, 2s. 6d. [334.]
Union of South Africa, Department of Agriculture.—Bulletin No. 74: Economic Series No. 10: Report on Co-operative Marketing. (53 pp.) Pretoria, 1930, 9d. [334 (68); 334.6.]
Union of South Africa, Department of Agriculture.—Bulletin No. 80: Economic Series No. II: The Principles of Co-operation. (40 pp.) Pretoria, 1930, 6d. [334 (68); 334.]

Botany

- Butcher, R. W.*—Further Illustrations of British Plants: Forming with Fitch's companion volume to Bentham's handbook a collection of illustrations of most of the species in the British Flora. Drawings by *Florence E. Strudwick*. (vii+476 pp.) Ashford, Kent: L. Reeve & Co., 1930, 12s. [58.19 (42).]
Royal Horticultural Society.—Index Londinensis to Illustrations of Flowering Plants, Ferns and Fern Allies being an Emended and Enlarged Edition continued up to the end of the year 1920 of Pritzels's Alphabetical Register of Representations of Flowering Plants and Ferns. Prepared under the auspices of the Royal Horticultural Society of London at the Royal Botanic Gardens, Kew, by *O. Stapf*. Vol. III. Earina to Justicia (555 pp.) Oxford at the Clarendon Press, 1930, £5 5s. 0d. [58.2.]

Meteorology

- Meteorological Office*.—The Weather Map. An Introduction to Modern Meteorology. (Second Edition. Entirely Rewritten.) (83 pp.) London: H.M. Stationery Office, 1930, 3s. [551.5.]
Shaw, Sir Napier, and Austin, Elaine.—Manual of Meteorology. Vol. III. The Physical Processes of Weather (xxviii+445 pp.) Cambridge University Press, 1930, 36s. [551.5.]

Soils and Fertilizers

- Emerson, P.*—Principles of Soil Technology. (402 pp.) New York and London: Macmillan, 1930, 14s. [63.11; 63.112; 63.113; 63.115.]
- Crowther, E. M.*—Soils and Fertilizers. (Reprinted from the Reports of the Progress of Applied Chemistry. Vol. XIV, 1929. (pp. 511-559.) Cambridge: Heffer, 1930. [63.11; 63.113; 63.16.]
- United States Department of Agriculture.*—Technical Bulletin No. 170: A Pipette Method of Mechanical Analysis of Soils based on Improved Dispersion Procedure. (23 pp.) Washington, 1930. [63.113.]
- New York State Agricultural Experiment Station.*—Bulletin No. 573: Artificial Manure from Straw. (17 pp.) Geneva, 1929. [63.162; 63.165.]
- United States Department of Agriculture.*—Technical Bulletin No. 182: Factors Affecting the Mechanical Application of Fertilizers to the Soil. (96 pp.+18 plates.) Washington, 1930. [63.16; 63.1625; 63.17.]

Field Crops

- West of Scotland Agricultural College.*—Bulletin No. 117: Phosphatic Manuring of Swedes. (pp. 181-190.) Glasgow, 1929. [63.332-16.]
- University of Leeds and the Yorkshire Council for Agricultural Education.*—No. 164: Results of Experiments with Cereals, Sugar Beet, Swedes, Mangels and Potatoes in Yorkshire, 1929. (16 pp.) Leeds, 1930. [63.3.]
- Lancashire County Council, Department of Agriculture.*—Farmers' Bulletin No. 47: Varieties and Manuring of Potatoes, 1929. Report on Field Trials. (19 pp.) Preston, 1930. [63.512-16; 63.512-194.]
- East Suffolk County Education Committee.*—Observations on Sugar Beet Growing in East Suffolk, 1929. (24 pp.) Ipswich, 1930. [63.3433 (42).]
- Agricultural Institute, Kirton.*—Trials of Stocks of Sugar Beet Seed, 1928. Preliminary Report. (2 pp.) Kirton, 1929. [63.3433 (42).]
- Harper Adams Agricultural College.*—Sugar Beet Problems: I. The Manuring and Cultivation of Sugar Beet, by *Sir J. Russell*; II. Sugar Beet from the Grower's Standpoint, by *E. Porter*; III. The Composition and Food Value of Sugar Beet By-Products, by *H. E. Woodman*. [Report of Third Conference held at the College on March 13, 1930.] (28 pp.) Newport, Salop, 1930. [63.3433 (42); 63.3433; 63.60432.]
- Harper Adams Agricultural College.*—Grassland Problems: I. The Making of Grassland, by *W. B. Mercer*; II. The Maintenance of Grassland, by *J. A. Hanley*; III. The Utilization of Grassland, by *R. Boufflower*. [Report of Conference held at the College on February 5, 1930.] (15 pp.) Newport, Salop, 1930. [63.33; 63.33-16; 63.711; 043.]
- Dominion of Canada, Department of Agriculture.*—Bulletin No. 122. New Series: Close-Grazing.—The Composition of Grass as Influenced by Frequency of Cutting (Grazing). (7 pp.) Ottawa, 1929. [63.33; 63.33-16; 63.60433.]
- Australian Council for Scientific and Industrial Research.*—Pamphlet No. 17: The Mineral Content of Pastures. Progress Report on Co-operative Investigations at the Waite Agricultural Research Institute. (29 pp.) Melbourne, 1930. [36.33; 63.60433.]

Horticulture

- The Gardener's Magazine and Register of Rural and Domestic Improvement.* Conducted by *J. C. Loudon*. Vols. 1-18. London, 1826-1842. [63.5.]
- Fletcher, F. J.*—Commercial Chrysanthemum Culture. (48 pp.) London: Benn, 1930, 2s. 6d. [63.522.]
- Michigan Agricultural Experiment Station.*—Special Bulletin No. 194: The Use of Peat in the Greenhouse. (28 pp.) East Lansing, 1930. [63.116; 63.5-19; 662.6.]
- United States Department of Agriculture.*—Farmers' Bulletin No. 1291: Preparation of Fresh Tomatoes for Market. (32 pp.) (Revised.) Washington, 1930. [63.513.]
- United States Department of Agriculture.*—Farmers' Bulletin No. 1620: Growing Cucumbers for Pickling. (18 pp.) Washington, 1930. [63.513.]
- Ohio Agricultural Experiment Station.*—Bulletin No. 447: Paper Mulch for the Vegetable Garden: Its Effect on Plant Growth and on Soil Moisture, Nitrates and Temperature. (60 pp.) Wooster, 1930. [63.191; 63.51.]
- United States Department of Commerce.*—Trade Promotion Series No. 90: Foreign Trade in Fresh Fruits. (103 pp.) Washington, 1930. [63.41; 38.]

Pests

- Nebraska Agricultural Experiment Station.*—Research Bulletin No. 44: Seed Potato Treatment Tests for Control of Scab and Rhizoctonia. (42 pp.) Lincoln, 1929. [63.24; 63.205.]
- United States Department of Agriculture.*—Farmers' Bulletin No. 1483: Control of Insect Pests in Stored Grain. (30 pp.) (Revised.) Washington, 1929. [63.27-31; 63.2945.]
- University of Bristol, Department of Agriculture and Horticulture.*—Bulletin No. 4: Mole Destruction Experiments. (15 pp.) Bristol, 1930. [63.269.]
- United States Department of Agriculture.*—Technical Bulletin No. 134: Red Squill Powders as Raticides. (36 pp.+1 pl.) Washington, 1929. [63.269; 63.295.]
- Korsmo, Emil.*—Unkräuten im Ackerbau der Neuzeit Biologische und Praktische Untersuchungen. [Nach dem Norwegischen Manuskripte des Verfassers Herausgegeben von Dr. H. W. Wollenweber.] (ix+580 pp.) Berlin: Julius Springer, 1930. 66 R.M. [63.259.]
- Commonwealth Prickly-Pear Board.*—The Progress of Biological Control of Prickly-pear in Australia. (44 pp.+12 plates.) Brisbane, 1929. [63.259; 63.296.]
- Empire Marketing Board.*—E.M.B. 29: The Biological Control of Insect and Plant Pests. A Report on the Organization and Progress of the Work of Farnham House Laboratory, by *W. R. Thompson*. (124 pp.+13 plates.) London: H.M. Stationery Office, 1930, 1s. [63.296.]

Live Stock

- Charlton, A. B.*—The Shire Horse Society, 1878-1928: A Chronicle of Activities spread over Fifty Years in the Development and Encouragement of the Shire Horse. (xvi+239 pp.+36 plates.) London: The Shire Horse Society, 1929, 21s. [63.6 (06); 63.61.]
- Winters, L. M.*—Animal Breeding. (x+389 pp.) (Second Edition.) New York: John Wiley; London: Chapman & Hall, 1930, 18s. 6d. [575.1; 575.4; 63.603.]

Wilts County Council.—Survey of the Pig Industry in Denmark and Sweden, by C. W. Whatley and W. T. Price. (12 pp.) Tonbridge, 1929. [Report of an inquiry promoted by the Wilts C.C.] [63.6 (489); 63.6 (485); 63.64.]

New Zealand Department of Scientific and Industrial Research.—Bulletin No. 17: Pig Recording, Bacon Manufacture and some aspects of the Pig Industry in New Zealand. (62 pp.) Wellington, 1930. [63.64; 63.752; 664.91.]

Gent, E. R.—The Experienced Farrier or Farring Completed, containing Everything that belongs to a Compleat Horseman, Groom, Farrier or Horseleach. In Two Parts: Physical and Chyrurgical. (Fourth Edition.) (499 pp.) London, 1720. [619.1; 63.61; 682.]

Youatt, W.—Cattle, their Breeds, Management and Diseases. (Published under the Superintendence of the Society for the Diffusion of Useful Knowledge.) (600 pp.) London: Baldwin & Cradock. 1834. [63.62.]

Dairy Cattle

Michigan Agricultural Experiment Station.—Technical Bulletin No. 105: The Results of a Five-Year Mineral Feeding Investigation with Dairy Cattle. (63 pp.) East Lansing, 1930. [612.394; 63.711; 043.]

Seale-Hayne Agricultural College.—Pamphlet No. 29: Report on the Elimination from a Dairy Herd of Cows Reacting to the Tuberculin Test. (8 pp.) Newton Abbot, 1928. [614.54; 63.711.]

Dairying

Prewett, F. J.—A Survey of Milk Marketing in Derbyshire, June, 1928. (70 pp.) Oxford at the Clarendon Press; London: Humphrey Milford, 1930, 2s. 6d. [63.716.]

County of Lanark.—Report on Special Investigation to Determine the Composition of Milk delivered under Marketing Conditions, by J. Hume Patterson. (22 pp.) Hamilton, 1929. [614.32; 63.712.]

Ling, E. R.—A Text Book of Dairy Chemistry. (213 pp.) London: Chapman & Hall, 1930, 6s. [543.2.]

New York State Agricultural Experiment Station.—Bulletin No. 581: Electric Cooling of Milk on the Farm. (20 pp.) Geneva, 1930. [63.71; 63.713.]

New York State Agricultural Experiment Station.—Technical Bulletin No. 157: The Creaming of Raw and Pasteurized Milk. (80 pp.) Geneva, 1929. [63.71; 63.717.]

United States Department of Agriculture.—Farmers' Bulletin No. 976: Cooling Milk and Cream on the Farm. (13 pp.) (Revised.) Washington, 1929. [63.71; 63.713.]

Walker-Tisdale, C. W., and Jones, Jean.—Butter and Cheese. (146 pp.) London: Pitman, 1930, 3s. [63.70; 63.72; 63.73.]

Seale-Hayne Agricultural College.—Pamphlet No. 32: The Manufacture of Butter, by W. E. V. Tresidder. (21 pp.) Newton Abbot, 1930. [63.72.]

Ministry of Health.—Reports on Public Health and Medical Subjects, No. 57: A Report on Determination of Sucrose, Lactose and Invert Sugar in Sweetened Condensed Milk. (23 pp.) London: H.M. Stationery Office, 1930, 6d. [543.2; 614.32; 63.715.]

McDowell, J. C., and Field, A. M.—Dairy Enterprises. (471 pp. +4 plates.) Philadelphia and London: J. B. Lippincott Co., 1930, 10s. 6d. [63.70.]

Bartolucci, Alfredo.—Produzione, Approvvigionamento e Controllo Igienico del Latte. (541 pp.) Milanese, 1929. [63.7 (45); 63.71.]

Poultry

Howes, H.,—Management of Farm Poultry with a View to Profit. (xvi+180 pp.) London: Chapman & Hall, 1930, 10s. 6d. [63.65.]

West of Scotland Agricultural College.—Bulletin No. 116: Report on Demonstration Poultry Crofts at Tiree and Crief. (pp. 165-177) Glasgow, 1929. [37: 63.65; 63.651.]

Hertfordshire Institute of Agriculture.—No. 265: The Herts County Egg-Laying Trials. (17 pp.) Oaklands, St. Albans, 1930. [63.651.]

Department of Agriculture for Scotland.—Miscellaneous Publications No. 10: Germicides and Disinfectants in Poultry-keeping. (24 pp.) Edinburgh, 1930, 6d. [614.4; 619.5; 63.651.]

Iowa State Agricultural Experiment Station.—Research Bulletin No. 119: Factors Influencing Egg Production. I. The Influence of Maturity upon Egg Production in S.C. White Leghorns. (pp. 309-332) Ames, 1930. [63.651.]

Union of South Africa Department of Agriculture.—Bulletin No. 59. (Economic Series No. 2): The Marketing of Poultry and Poultry Products. (80 pp.). Pretoria, 1930, 1s. [63.65; 63.741; 63.753.]

Bees

Mace, H.—Bee Matters and Masters with an appendix Who's Who in Beekeeping. (144 pp.) Harlow: "The Beekeeping Annual" Office, 1930, 5s. [63.81.]

Simmins, S.—A Modern Bee Farm and its Economic Management. (Revised edition.) (497 pp.) The Author, Heathfield, Sussex, 1928. [63.81.]

United States Department of Agriculture.—Technical Bulletin No. 149: Fungous Diseases of the Honeybee. (43 pp.+6 pl.) Washington, 1930. [63.81: 09.]

Veterinary Science

United States Department of Agriculture.—Miscellaneous Publication No. 68: The 1929 Outbreak of Foot-and-Mouth Disease in Southern California. (16 pp.) Washington, 1930. [619.2.]

Minnesota Agricultural Experiment Station.—Special Bulletin No. 126: Hog Cholera. (22 pp.) (Revised.) St. Paul, 1929. [619.4.]

California Agricultural Experiment Station.—Bulletin No. 486: Pullorum Disease (Bacillary White Diarrhoea of Chickens.) (31 pp.) Berkeley, 1930. [619.5.]

THE JOURNAL OF THE MINISTRY OF AGRICULTURE

Vol. XXXVII. No. 8.

NOVEMBER, 1930.

NOTES FOR THE MONTH

THE Report* on proceedings under the Diseases of Animals Acts for the year 1929 has now been issued. Part I of the

Diseases of Britain with regard to animal diseases
Animals Acts : and gives the record of the outbreaks of
Report for 1929 scheduled diseases which occurred during the year. It shows the progress made in

the reduction of cases of foot-and-mouth disease, sheep scab, anthrax, parasitic mange of horses and the notifiable forms of tuberculosis. It also describes the increased prevalence of swine fever during 1929 and the measures taken to deal with it. The section dealing with bovine tuberculosis contains a review of the results of the administration of the Tuberculosis Order of 1925 during the four years of its operation (1926 to 1929). Papers are also reprinted which were read by Sir Ralph Jackson, M.R.C.V.S., Chief Veterinary Officer of the Ministry, at meetings in Paris in June, 1929, of the International Office of Contagious Diseases of Animals, on :—

- (a) The tonacity of the virus of foot-and-mouth disease under field conditions, and
- (b) The introduction to Great Britain of anthrax infection by means of products of animal origin.

In Part II will be found a review of the administration of the measures taken to prevent the introduction into and spread of disease in this country, and for the protection of animals from unnecessary suffering during transit by land and sea ; particulars of the animals imported from Ireland and other countries and the cases of disease therein ; also a statement of the casualties which have occurred during the transit of animals.

Part III contains a brief summary of the diagnostic work done at the Ministry's Veterinary Laboratory at Weybridge in cases of certain scheduled diseases, including lists of the specimens received at the Laboratory for examination and

* *Report of Proceedings under the Diseases of Animals Acts for the Year 1929.* His Majesty's Stationery Office, Adastral House, Kingsway, London, W.C.2. Price 2s. net.

report. Research work is dealt with in separate reports or by contributions to scientific journals.

Part IV describes the working of the London Quarantine Station for pedigree stock intended for export to the British Dominions and Colonies, and gives particulars of work which is being carried out in connexion with the reduction of the warble fly pest.

The Appendixes to the Report contain the usual statistical tables of animal diseases confirmed in Great Britain during 1929 and of animals imported and exported, and in addition a table showing the incidence of animal diseases in European countries during the years 1928 and 1929, and a table showing the number and breeds of each class of pedigree stock exported through the London Quarantine Station during those two years.

THE Imperial Bureau of Soil Science, of which some account has already been given in this JOURNAL (Vol. XXXVI, No. 10),

Conference of problems from September 16-18 at
Imperial Bureau Rothamsted Experimental Station, Har-
of Soil Science pendden, with which it is in close asso-
ciation.

The promotion of personal contacts between soil research workers of the Empire is one of the Bureau's chief objects, and the first day of the Conference was accordingly made the occasion of the annual visit of Empire agricultural officers to the Station. The visitors, who included representatives from Australia, Canada, Ceylon, Gold Coast, India, New Zealand, Nigeria, Sierra Leone, South Africa, Straits Settlements, Federated Malay States, Sudan, Trinidad, Uganda and Great Britain, were entertained to lunch, after a tour of the farm during which the classical and modern experiment plots were demonstrated. After the luncheon the Conference was formally opened by the Rt. Hon. W. G. A. Ormsby-Gore, P.C., M.P., and later an inspection of the laboratories was made and the work of the various departments demonstrated in groups.

Serious Conference work began on the following day, when Sir A. D. Hall presided over a discussion on the present position of soil analysis. The first discussion, on the mechanical analysis of soils, was opened by Professor G. W. Robinson (Bangor) with an account of his work in comparing methods proposed by the International Society of Soil Science.

Modifications in the technique of the methods and their application to tropical soils were dealt with in some detail during the course of the discussion.

Mr. A. W. R. Joachim (Ceylon), opening a second discussion on available phosphorus and potash in soils, gave a brief outline of the present position of the subject with particular reference to the reliability of laboratory tests for availability and the physiological methods of Mitscherlich and Neubauer, suggesting that more use might be made of data for exchangeable potassium as an index of potash requirements. Later in the discussion the more extended use of the physiological methods in this country was advocated ; and it was pointed out that on the Continent, particularly in Germany, farmers relied to a considerable extent on the physiological indications of the need for potash or phosphate dressings to the soil. Though soil fertility conditions in Germany were not the same as in this country, experiments there were proceeding on the right lines—from field experiment to the laboratory—whereas here the reverse held, resulting in a mass of laboratory data uncorrelated with field work. Following further discussion, it was agreed that more field and laboratory tests, carried out in parallel, were needed in this country.

The subject of soil reaction and lime requirement was then opened by Mr. P. E. Turner (Trinidad), who dealt with the correlation of soil reaction measurements with the state of saturation of the soil with lime. In the ensuing discussion, among other points, reference was made to the value of pH determinations of the soil as a diagnosis of soil fertility, especially in its bearing on the tolerance of specific plants. Sugar beet, for instance, was said to fail at a pH below 5.3.

At the afternoon meeting the Chairman, Dr. A. C. D. Rivett (Australia), opened a discussion on the work of the Bureau. Sir David Chadwick, Secretary of the Executive Council of the Imperial Agricultural Bureaux, referring to the need of unity among research workers of the Empire which presaged the inauguration of the Bureau at the Imperial Agricultural Research Conference of 1927, said that the financing of the Bureau from a common fund derived from contributing Governments marked a new departure in the constitution of the Empire. The work of the Soil Bureau for the year was then outlined by the Director, Sir E. J. Russell. In the general discussion that followed recommendations were made, many by overseas representatives, the object being to increase the usefulness and efficiency of the Bureau's

activities. At the close of a detailed discussion the proposal that the Bureau should hold a one-day informal annual Conference was adopted.

The morning of September 18, devoted to a discussion of soil survey work, with Sir Thomas Middleton as Chairman, began with an address on the soil resources of the Empire by Sir E. J. Russell, in which he said that no basis sufficiently broad to allow the comparative study of regions so widely scattered as those of the Empire had existed until recent years. The grouping of soils was determined by climatic and geological factors. Topographical features also played an important part; but as a first approximate generalization, similar climatic conditions might be said to produce similar soil types, and a tendency to form similar agricultural conditions. Slides showing the different types of farming conditions found throughout the Empire were shown in illustration of this. He then went on to say that a survey of the soil resources of the Empire would serve many purposes. It would inform the Governments of the Empire of the agricultural possibilities of their land. The information would be the best obtainable and would be subject to the minimum of guess work such as had weakened so many estimates of the past. Canada afforded admirable illustrations of the dangers of prophecy. For the last 35 years forecasts had been made, without adequate knowledge of the soils, of the probable limits of wheat cultivation, which, with one exception, had all proved to be false. Still more important, such a survey would focus attention on the possibilities of agricultural development of the Empire as a whole. In concluding, he said that among manufacturers of the Empire there was a general working towards mutual agreements to reduce unnecessary competition and over-production: the agricultural scientific workers of the Empire were now organized through the Agricultural Bureaux to pool their information and ensure the maximum result for their efforts. It remained to bring about an organized agriculture for the Empire, based on sound soil and agricultural surveys, to ensure the best use of Imperial resources.

A discussion on the position of soil surveys in the Empire was then opened by Dr. F. J. Martin (Sierra Leone) with a description of a survey undertaken by him which resulted in an extension of rice growing areas in Sierra Leone. Examples of similar extensions were instanced during the discussion. Sugar cane crops had been considerably extended in India through irrigation, by carrying out survey work which

distinguished between areas that would, or would not, respond to irrigation. The need for further work of that kind, especially in North-west India, and for the examination and correlation of official data already available, was stressed. Some accounts of the areas already surveyed in the Empire were then given.

In the next discussion, on the classification, mapping and profile examination of soils, opened by Dr. W. G. Ogg (Edinburgh), it was suggested that uniformity in the classification of soils could be furthered by discussions between surveyors of a large area at a central station; that there might be more extended use in survey work of aerial photography, which had been used with success in defining areas of sheep sickness in New Zealand; and that co-operation between soil surveyors and geologists is advisable.

The last discussion, on methods of field experimentation, presided over by Dr. P. J. du Toit (South Africa), began with an account by Dr. J. Wishart (Rothamsted) of plot lay-out in manurial experiments based on the statistical methods in use at Rothamsted. In further discussion he was able to put forward the advantages of the randomized block and latin square methods over the older systematic arrangements. Errors in the analysis of yield data in fertilizer experiments on cacao or coconut trees, due to lack of uniformity of seed or size of roots, were instanced, and this led to a discussion on the most suitable size of plot to be adopted for tree crops, and to the further question of eliminating errors in pasture fertilization experiments with grazing animals.

The first evening of the Conference was spent at a social gathering at Rothamsted, the second at a joint meeting of the British Empire Section of the International Society of Soil Science and the Soils Sub-committee of the Agricultural Education Association. Professor J. Hendrick (Aberdeen) deputized for Professor N. M. Comber (Leeds) at this meeting, when the Russian Soils Congress and the organization of the British Empire Section were dealt with in a partly informal discussion.

* * * * *

THE Ministry of Agriculture desires that full use should be made by mycologists and plant pathologists in this country of the facilities offered by the Imperial Bureau of Mycology. This Bureau has been supported financially by contributions from the Governments of the Dominions, India, the Sudan, Iraq and most of the Colonial Dependencies. The British Government

**Imperial
Bureau of
Mycology**

has hitherto not made any financial contribution, its aid having taken the form of the provision of a Government building for use rent free by the Bureau. A new and more commodious building has been erected to house the Bureau, near the Herbarium at Ferry Lane, Kew, and arrangements are being made by which substantial financial aid shall be given in future by the three home Governments, which will enable the Bureau to extend the scope of its activities.

The Bureau is directed by Dr. E. J. Butler, C.I.E., F.R.S., D.Sc. For the purpose of dissemination of information it publishes the *Review of Applied Mycology*, which gives a monthly survey of all current literature dealing with phytopathology and economic mycology from every part of the world. Imperial Mycological Conferences are held, under the auspices of the Bureau, at intervals of five years. It undertakes the identification and study of fungus and bacterial plant pathogens; and it maintains a museum of tropical plant diseases and a lending library for the use of mycologists.

* * * * *

THE World Agricultural Tractor Trials were held under the auspices of the Royal Agricultural Society of England, in conjunction with the Institute of Agricultural Engineering, University of Oxford. A report has been published of the results of the tests carried out by the staff of the Institute in connection with the trials.

**World
Agricultural
Tractor Trials**

The first section of the Report gives a full description of the methods by which the tests were conducted. A note on the general test on tractors follows, together with a brief account of the road test for which only two machines were entered. The tests of market garden cultivators are dealt with separately. In the final section of the Report an illustration and specification of each machine is given.

The tests of the tractor entries were carried out near Wallingford during the period June 2 to July 26. Only three machines failed to carry out the full programme. One machine was withdrawn owing to a change of arrangements on the part of the makers, and two on account of mechanical breakdown.

The object of the tests, and of the trials generally, was not to determine which tractor was the best in its class, but simply to show what each machine was capable of doing under normal conditions. The report is, therefore, confined to the actual results of the tests, together with notes on points directly connected with them. Any farmer contemplating the purchase

of a tractor must decide for himself which machine will best suit his purpose, having regard to the work which he will require the tractor to do and the conditions under which he would require it to work.

Public demonstrations of the machines tested took place on September 16 to 19 at Ardington, near Wantage.

* * * * *

THE following is a summary of the revised results for Great Britain of the 1929-30 beet sugar manufacturing season as compared with the previous year. With the exception of acreage, which was exceeded only in 1927-28, the season was in all other respects, both from the agricultural and factory standpoint, the best on record. According to the preliminary returns for June 4, 1930, the acreage under sugar beet this year was estimated at 348,100 acres as against 230,553 acres in 1929, an increase of over 50 per cent.

	1929-30	1928-29
Acreage under sugar beet	230,553	178,047
Average yield per acre (tons)	8.7	7.7
Number of beet growers	32,204	25,050
Number of factories	19	19
Average number of days worked	91	72
Number of workers employed in factories during the campaign	8,854	8,172
Tonnage of beets delivered to factories ..	2,003,586	1,369,781
Average sugar content of beets (per cent.) ..	17.7	17.4
Average price paid per ton of beet ..	52s. 11d.	51s. 11½d.
Estimated total sum, including cost of transport, paid by the factories to the growers	£5,301,000	£3,559,000
Total production of sugar (cwt.)	5,841,489	3,904,172
Average extraction of sugar expressed as a percentage of beets delivered to factories ..	14.6	14.25
Average extraction of sugar expressed as a percentage of total sucrose in beets ..	83	82
Average farm output of sucrose per acre of beet grown (lb.)	3,440	2,995
Average factory output of commercial sugar per acre of beet grown (lb.)	2,837	2,456
Production of by-products :—		
Molasses (cwt.)	1,480,051	980,095
Pulp (Dry) tons	138,686	97,451
(Wet) tons	21,212	8,208
Subsidy paid :—		
Sugar	£3,794,288	£2,534,492
Molasses	439,488	290,328
Total	£4,233,776	£2,824,820

ACCORDING to returns made to the Ministry by the beet-sugar factories operating in Great Britain, the total quantity of home-grown beet sugar manufactured during September, 1930, together with the quantity produced during the corresponding month in 1929, was :—

				cwt.
September, 1930	..	..	..	198,575
September, 1929	..	..	..	11,905

The total quantities of sugar produced during the two manufacturing campaigns to the end of September were :—

				cwt.
1930/1931	..	..	..	198,575
1929/1930	..	..	..	11,905

THE following note on Winter Food Mixtures for Dairy Cows and Fattening Pigs has been communicated by Mr. J. K. Thompson, N.D.A., of the Agricultural Institute, Kirton :—

Winter Food Mixtures

For Dairy Cows.—A good many inquiries are coming to hand relative to the use of dried sugar-beet pulp and home-grown grains in production mixtures for dairy cows.

A mixture designed to incorporate sugar-beet pulp which has been widely and successfully used in this area during the past two seasons is as follows :—

Decorticated ground nut cake	..	..	2 parts by weight.
Crushed oats	..	..	3 " "
Dried sugar-beet pulp	..	..	2 " "

The mixture is made up and fed dry at the rate of $3\frac{3}{4}$ lb. per gallon of milk.

In some cases where stocks of beans and cereals are held the following alternative mixtures are being advised :—

- (a) Beans 4 parts by weight.
- Oats or wheat or both 2 " "
- Barley, maize or sugar-beet pulp or all three 1 part "
- (b) Decorticated ground nut cake 1 " by weight.
- Oats or wheat or both 2 parts "
- Beans 2 " "
- Barley, maize or sugar-beet pulp or all three 2 " "

Feeding in each case at the rate of $3\frac{1}{2}$ lb. per gallon of milk.

For Pigs.—The following two tables give mixtures that have proved extremely successful in the feeding of store and fattening pigs, and which should meet the requirements of many pig feeders in this country.

For pigs over 4 months old and up to the finishing off period :—

	<i>Mixture 1.</i>	<i>Mixture 2.</i>	<i>Mixture 3.</i>
Extracted Soya meal..	$\frac{1}{2}$ cwt.	$\frac{1}{2}$ cwt.	$\frac{1}{2}$ cwt.
Sharps	$4\frac{1}{2}$ „	5 „	$5\frac{1}{2}$ „
Barley meal	5 „	$2\frac{1}{2}$ „	$1\frac{1}{2}$ „
	10 cwt. meal	8 cwt. meal	7 cwt. meal.
Cooked potatoes ..	nil	8 cwt.	12 cwt.

The mixtures 2 and 3 meet the requirements of those who have on hand chat and other unsaleable potatoes. Dried sugar-beet pulp may, if required, be used in these mixtures in replacement of some of the barley meal, but the quantity used should not exceed 20 per cent. of the whole ration, and where sugar-beet pulp is added the material is preferably fed dry, the dry system of feeding being adopted.

At Kirton it has been found that pigs will not take pulp satisfactorily if it is fed after previous soaking or in the wet system of feeding. Satisfactory results are obtained with it if fed as noted, and no trouble in any form has been experienced in feeding the pulp dry.

If the pigs are being carried on merely as stores, the potatoes may be fed raw, but where the pigs are being pushed on the tubers should be cooked. Unless the pigs have a free range the use of a mineral mixture in conjunction with these mixtures is advisable.

These mixtures may be used in the feeding of empty and in-pig sows in the first stages of pregnancy. In this case they should be associated with a free range or a mineral mixture. It should also be remembered that the total bulk of the ration must be reduced as pregnancy advances, and therefore the proportion of potatoes must be gradually reduced. The mixtures are not advised as suitable for use right up to the time of farrowing.

In the case of finishing pigs the table below indicates four alternative mixtures :—

	<i>Mixture 1.</i>	<i>Mixture 2.</i>	<i>Mixture 3.</i>	<i>Mixture 4.</i>
Barley meal ..	$6\frac{1}{2}$ cwt.	4 cwt.	$2\frac{1}{2}$ cwt.	1 cwt.
Sharps	$3\frac{1}{2}$ „	4 „	$4\frac{1}{2}$ „	5 „
	10 cwt.	8 cwt.	7 cwt.	6 cwt. meal.
Use with cooked potatoes ..	nil	8 „	12 „	16 „

Again dried beet-pulp may be substituted up to a limit of 20 per cent. of the total mixture. The potatoes are advisedly fed cooked to finishing pigs. For finishing pigs no mineral

mixture is necessary provided the animals have been satisfactorily fed in the earlier stages.

The mixtures given in both the foregoing tables represent cheap combinations, particularly where chat potatoes are available on the farm. As a point to be noted, however, it is assumed that the young pigs have been fed on a soundly-constructed ration before arriving at the age at which the use of the above rations can be recommended.

THE Ministry has had before it reports as to the experience gained in recent years in various countries where foot-and-mouth disease is endemic in the use of

Foot-and-Mouth	a new weapon for the prevention of the
Disease : Serum	spread of disease, namely, the adminis-
Inoculation	tration of serum treatment to animals
	which have been in contact with diseased

animals or which have been otherwise exposed to infection.

Serum contains no curative properties, nor will it prevent the development of the disease in an animal which is already in the incubative stage. If, however, serum is administered to an animal which, although not itself infected, may be exposed to the danger of infection, experience abroad shows that it will afford protection against the disease for a period of about ten days in a high percentage of cases.

These results warrant a close examination of this subject in relation to actual outbreaks in this country, inasmuch as the temporary protection which may thus be secured to animals which are exposed to infection may be expected to :—

- (a) diminish secondary outbreaks in the immediate vicinity of the original centre, and thus limit the number of foci to be dealt with ;
- (b) reduce the number of animals which it is necessary to slaughter for the purpose of preventing the spread of disease, and
- (c) at the same time reduce the areas over which it is necessary to impose restrictions upon the business of farmers and livestock salesmen.

In these circumstances the Ministry decided to apply serum treatment to a number of outbreaks in which the circumstances are favourable, and on September 19 made an Order making provision for this purpose. In the first instance this procedure will be of an experimental character and the results will be closely examined before the question of the adoption of serum procedure as a general rule is considered. During the progress of this experiment the slaughter policy which has been the means of eradicating the disease from this country for many years will remain the basic policy.

A BIOLOGICAL WALK IN WINTER

Sir J. ARTHUR THOMSON, M.A., LL.D.,

*Emeritus Professor of Natural History in the University of
Aberdeen.*

IN northern or southern countries winter means, for familiar astronomical reasons, a great reduction in the supply of light and heat that the earth receives from the sun. This primary difference between winter and summer has associated secondary differences, such as the shorter day (in which plants and animals can do their work); various conditions, such as lessened evaporation and the binding of the earth with frost, which greatly hinder the circulation of water (the meteorological cycle, as it is called); the fall of snow with its many benefits and many risks; also severe storms and so forth.

We all know, more or less, what is meant by winter—the annual recall of the Ice Ages of the past, oftenest ages of severe sifting, but occasionally of progressive effort.

Life at its Low Tide.—If we take a biological walk in summer, when life has its high tide, our difficulty often is that there is too much to see. The stage is crowded; there is a bustle of life in hedgerow and meadow, in pond and shore.

In winter, however, there is often relatively little to see, unless we have plenty of time and more than an everyman's knowledge of where to look for the creatures that are in hiding. Often, especially in the north, we must be content to see two or three things each day, which gradually combine into our winter-picture. We envy those who are able, through long patience and practice, to tell us whose are all the footprints on the snow; where the hedgehog is lying in his winter-sleep; what winter-visitor birds have come to the estuary; where the frogs are ensconced stiff and stark, mouth shut, nose shut, eyes shut, hardly breathing at all; where the bats are hibernating, hanging head downwards by their toes and wrapped up in their leathery arms; and so on.

We went one day into the Californian Desert with a naturalist who knew it well, and we had not been there five minutes before he said: "Do you know the lizard called *Xantusia*? There's a species here that lives under the loose bark of the Joshua tree, hunting for spiders and other small fry. There's just the sort of place where it lives." Whereupon he laid his hand on the loose bark of the tree in question (one of the Yuccas, a sort of tree-lily), and produced a much startled *Xantusia*! It looked like magic, but it was only a

vivid instance of that observational skill which all of us can in some measure attain along some line or other. It certainly adds to the joy of life.

Life Lying Low.—Winter is a time of *lying low*, as in the snails shut up in their shells far in the recesses of that old wall. Below the level of the shell opening, there is a lid of hardened lime and slime, with a small aperture through which an interchange of gases takes place. The snail itself is in a somewhat collapsed state, for its heart is beating very, very feebly, and the tissues of one that we dissected were distinctly under par, worse than flabby.

Before we pass the old wall we must pay tribute of admiration to the lichens which are spreading in strange orange-coloured patterns over the stones. Does life ever endure under greater difficulties—exposed on the surface of a wall? Fine threads insinuate themselves into microscopic crevices and absorb dissolved salts; the coloured part of the lichen absorbs air and the green cells build up carbon-compounds, just as in any ordinary green leaf. The secret of success is partly this, that every lichen is a combination of two quite different plants—a green alga and a colourless fungus, which work into one another's hands (symbiosis) and prosper. In the circulation of matter that is always going on in the world, these lowly lichens play their part, for they begin the weathering of the rocks, and we find them at work on the tops of the hills, making a primitive kind of soil which is eventually carried by runlets and streamlets to the distant valley and the farmer's fields.

Life in Hiding.—If you have time to rest on the wall, it is interesting to pull off some of the low-growing moss, which flourishes in the soil that the lichens have made, added to, no doubt, by dust-particles blown upwards from the road and carried down by the rain, helped also, of course, by the dead bodies of small creatures, both animals and plants, which bacteria have decomposed. When we uproot some of the mosses (to be packed into a hole when we pass on), we disclose a Lilliputian world, which a lens helps us to scrutinize. There are the tiniest snails and just visible worms, there are miniature insects and their larvæ, also some very interesting primitive wingless insects and some old-fashioned millipedes. We were pleased to find an old friend called *Orthesia*, a squat ca'canny insect, with a wax-white trailer behind its body, and this was full of developing eggs. Ever so much smaller, of course, are the microscopic animals of the primitive soil of the wall

crevices. With these there are few of us who can do much, but it is worth while to select a hundred yards of old wall and chronicle, week after week, the plants and animals that we can find on it, without including those that we cannot see with the naked eye. We soon discover that life is much more abundant—even in winter—than we at first suspected.

Suspended Animation and Winter Sleep.—Among the many different forms of “lying low” in winter we must include:—

(a) the relapsed life of some insect pupæ, where the body of the larva (*e.g.* maggot) has become greatly simplified in structure, in fact almost embryonic again;

(b) the arrested development of other insect larvæ, such as caterpillars and pupæ, where the metamorphosis into the winged form has ceased for the time being, like a stopped watch;

(c) the suspended animation of many small creatures, like Bear-Animalcules (some of them quaintly like microscopic hippopotamuses) and Wheel-Animalcules and small thread-worms, in which we can detect no vitality for the time being;

(d) the comatose state of snails and frogs, where we can see the beating heart, though the life of the body as a whole is at a very low ebb; and

(e) the state of true hibernation, restricted to a few mammals, such as hedgehog and dormouse, marmot and bat. Unlike ordinary warm-blooded mammals, and birds too, which are able to keep up the same body-temperature year in and year out (which is what warm-bloodedness means), the imperfectly warm-blooded types, such as the four mentioned, are unable to produce enough of animal heat to make good what they are losing in the cold weather. So they sink back into a peculiar state, very unlike normal sleep, with most of the vital functions (even excretion) in abeyance, with the heart beating very feebly and the breathing movements scarcely perceptible. This relapse into reptilian cold-bloodedness (and mammals evolved from an extinct Reptile stock) would soon be fatal in the open; but it is linked to the instinct to seek out a sheltered nook, where the temperature soon rises a little above that outside, and the retreat is warmed enough to keep the blood of the winter-sleeper from freezing.

Shelters and Retreats.—Along with the lying-low solution we must include the discovery of shelter, and this habit accounts in no small part for the bareness that marks our country walk along the path, through the copse, across the stretch of moor, and along the river-side. There are many

more animals than we see ; they are hiding in shelters difficult to find. We split up 12 hemlock stems with a knife, and found 12 animals right away ! In some cases, to be sure, the shelter is not here, but far away ; and this brings us to the migration solution—conquering the winter by evading it. As we skirt the low moor we see some white hares scampering ; they have put on a white dress which economizes the loss of heat and may also provide a cloak of invisibility against a background of snow ; but the point just now is that these Variable Hares have migrated from the high hills, where the food is too deeply covered by snow, to the low grounds where they run an obvious risk from conspicuousness, but none of starvation. So the reindeer migrate in Newfoundland, and the majority of our British birds seek the south.

Where the river joins the sea we may be lucky enough on our walk to discover a Little Auk, a Great Snipe, a Northern Diver, or some other “ winter visitor ” bird, which finds our shores quite genial compared with the severities of the Arctic breeding-places frequented in summer. On the links we met a flock of Snow Buntings, singing in their flight, just arrived from across the North Sea, and making for the fields where they may refresh themselves with seeds after their long journey. Those of us who live in the North of Scotland sometimes find it a little difficult to believe in creatures that choose our country for winter-quarters !

Retrenchment.—As we stroll along the river, which has ice at its edges in many places, we notice the scarcity of life ; and this strikes us most in regard to certain flood-pools or miniature ponds which we know to be teeming with animals in the summer. Most of their tenants are in hiding, and we feel a deep-down gratitude that water has the almost unique property of expanding as it freezes. Its maximum density, when the molecules are most closely packed, is at 4° Centigrade, and if the temperature falls further, towards the freezing-point or zero, the volume increases and the freezing water rises to the surface of the pool, where it forms a blanket of ice. Thus in winter the temperature at the floor of the pool is higher than at the surface ; it is, therefore, difficult for the pool to freeze solid ; and this means a very important conservation of aquatic life during the cold months in northern and southern latitudes. Some one should write a panegyric of water !

Our walk takes us through a little wood, including some fine beech trees, and the crickle-crackle of the leaves beneath

our feet reminds us of another way in which living creatures meet the winter—by retrenchment and by reduction of vulnerable surface. The leaves have worked hard all the summer, making carbon-compounds, and they must be in some measure worn out. After they have surrendered to the branches almost all that they have that is worth having, they are separated off and fall to the ground, where the earthworms bury some of them, thus adding to the invaluable vegetable mould, soon to be re-incarnated in the trees. So the world goes round ; but our present point is simply that it pays most trees to shed their leaves in the fall. It is a useful reduction of vulnerable surface, for ordinary leaves that managed to continue with abundant water in their cells and vessels would run the obvious risk of having these ruptured by freezing.

The same retrenchment or reduction of vulnerable surface is seen in some zoophytes and even more complicated animals, but the adaptation is especially characteristic of plants. Yet we see it on a higher turn of the spiral when all the humble bees of the summer community and all the wasps of the nest die off in early autumn, except the young queens who alone survive the winter.

It is interesting to go back to one of the river-pools where the washed roots of the alder-trees and the bases of the bulrush stems are encrusted with the freshwater sponge. This was vigorous and distinctly green in summer, the green colour being due to countless numbers of microscopic partner-algae, whose manufactured carbon-compounds help to feed the sponge ; but now it looks rather the worse for wear. It is moribund, but all through its body there are clusters of cells forming microscopically beautiful gemmules, which live on and start new sponges in spring.

A Triumph of Weeds.—The corner of the moor looks rather fine in the winter sunshine which lights up the withered bracken. But, except æsthetically, we cannot approve of it, for the bracken is a disastrous weed, spoiling fine pasture-slopes and conquering even the heather. As we look at it we know of course that all that we see is dead ; yet next year it will be more luxuriant and rampageous than ever. The secret is all too familiar, that the strong underground stem or rhizome is well-protected beneath the ground, and richly stored with nutritive reserves which will be mobilised in spring. So storing is another way of meeting the winter ; and we can link the bracken to the squirrel with its stores of

beech-nuts in the wood—so different and yet the same in idea.

Man Following Nature's Lead.—As we come back again towards the farm, an interesting thought arose in our mind, that man often follows Nature more than he knows. Thus in regard to this problem of meeting the winter, many of the human solutions are closely parallel to Nature's. More or less unconsciously, similar problems find similar solutions. Many animals go into hiding or shelter; so man brings his cattle in some measure indoors. In the "black houses" of the Hebrides, the cow is brought, on the approach of winter, into one end of the crowded dwelling, for it requires less food indoors and is safe from storms. When spring comes, it has to be lifted out, so great is its weakness. So some species of ants take *their* cows—the green-flies or aphids—into an underground stable for the winter, and look after them too, till they can be carried out again in spring, for the day at least. In some cases the "*vaccæ formicarum*," as Linnæus called them, are taken into shelter every summer evening; and again we think of man ca'ing the cattle home.

The farmer provides for the winter by storing food, such as hay and turnips, for his stock, following the lead of the hamster with its chopped grass, the beaver with its cut branches, the squirrel with its beech-mast, the hive-bees with their honey, the Californian woodpeckers with their thousands of acorns firmly fixed in holes in the bark of oak-trees. Our fathers knew the change it meant when the extended cultivation of turnips made it possible to feed cattle and sheep in a satisfactory way throughout the winter, the farmer thus utilizing the plant's nutritive reserves for a secondary purpose of his own. In a way this is very elementary, but it is a thought worth pursuing, that man, consciously or unconsciously, has followed Nature in various solutions of the problem of winter.

We look into the stable and we see some of the more delicate horses well wrapped-up in horse-blankets, thus afforded the advantage which many wild creatures attain by thickening their coat of hair. How shaggy the domesticated Shetland Pony becomes in winter, just like the Yak amongst the snow on the Tibetan Uplands. At the end of summer the Swiss crofter brings his cattle and goats down from the "Alp" (as his high-level pasturage is called) and keeps them in shelter till the snows have gone—a device evidently paralleled by the migration of many birds and mammals.

We have spoken of the drastic elimination that is often characteristic of winter, and we can never forget one deadly

night of frost after which were gathered about two hundred dead birds (a big barrowful) from one farm steading. So man reduces his stock, sometimes beginning with those that are least promising of survival, but sometimes beginning with the best, in the hope of fattening up the others.

We need not pursue the Farmer-Nature analogy further, and we have too much respect for him and for ourselves to speak of the farmer hibernating, though there is an approach to this in some remote parts of Russia and Siberia when the inmates of the farm-house huddle together round the stove and do not really waken except at long intervals. Better than that would be another biological walk !

RESEARCH AND THE BREEDING OF APPLES

(A Lecture delivered at the Bristol Meeting of the British Association)

Sir A. D. HALL, K.C.B., LL.D., F.R.S.,

Chief Scientific Adviser to the Ministry and Director of the John Innes Horticultural Institution.

You may wonder why I should propose to spend an important hour in talking about such a trivial subject as "apples." Apples are all very well, you think, as you help yourself to apple pie, but why cannot they be left to the gardener and the cook ? Well, I chose the subject for two reasons, first because it affords a good illustration of how research, real research into fundamentals, the pursuit of knowledge for its own sake, suddenly begins to illuminate and direct the procedure of the practical man. Secondly, here in Bristol exists one of the most active agencies obtaining this sort of knowledge, the Fruit and Cider Institute at Long Ashton, of whose work Bristol citizens may well be proud. I am not going to tell you what Professor Barker and his colleagues are doing : they are better fitted to expound it themselves. I am going to take you into a remoter region of investigation, where some colleagues of my own are at present occupied. This is the way of science ; we are all pushing against the boundaries of a universe that ends on all sides in obscurity. There is an area reasonably well lighted and with adequate communications, but which fades off in every direction into the unknown, and each worker or group of workers is trying to strike a path or clear a way into it. The paths are independent, but if the work is well done they all piece together eventually into a trustworthy map by which to walk.

Apples present many fruitful lines for investigation. At Long Ashton the research workers are trying to find out why apple trees should bear generally in alternate years, a bumper crop followed by few or none, why apples should be highly coloured and well flavoured in one orchard and not in another, and many other kindred questions. At East Malling they are ascertaining the effect of stocks upon which apple trees are grafted, and how thereby to secure uniformity of growth and quality in the produce. What I am going to confine myself to is the breeding of apples and the conditions which govern the production of new improved varieties.

As with many of our domestic plants, the origin of the apple is unknown and belongs to the early world; it is even uncertain whether our wild apples are native to the country. At any rate we can be pretty sure that the cultivated apple came in the track of the Romans, either directly or at second hand. Roman agriculture persisted along the old lines of communication, as in Flanders, from which so much of our later farming practice was derived. Richard Harrys, fruiterer to King Henry VIII, bought land in Teynham (Kent) and "bought plants beyond the seas and furnished the ground with them." From this garden the Kentish fruit growing developed.

Coming nearer to our times, the origin of most of the varieties still cultivated was very much an affair of chance. We read of so excellent an apple as Claygate Pearmain that it was "discovered by John Braddick, Esq., growing in a hedge near his residence in Claygate," or of Cox's Orange Pippin, now world-wide in its distribution, that it was "raised at Colnbrook Lawn, near Slough, by a Mr. Cox, who was formerly a brewer at Bermondsey and who retired to Colnbrook where he devoted the remaining years of his life to gardening pursuits." The apple was raised in 1825 and is said to have been from a pip of Ribston Pippin.

The first man to set about the scientific breeding of apples was Thomas Andrew Knight (1759-1838) of Elton in Herefordshire. He began to make use of the knowledge, first imperfectly apprehended a century earlier, that sex exists in plants, and that in the formation of the seed the pollen participates as well as the ovule which grows into the seed. A new variety, then, has a male as well as a female parent, and Knight says, "New varieties of every species of fruit will generally be better obtained by introducing the farina (pollen) of one variety of fruit into the blossom of another, than by

propagating from one single kind." Knight raised new varieties of apples, pears, peaches and cherries by deliberate cross-fertilization. Of his apples, "Yellow Ingestrie" is still grown and may be regarded as the first apple of known parentage. From Knight's time the method of cross-breeding has been generally known and followed. Pedigrees are not always declared, and most of the varieties we grow are still of unknown parentage, at least on one side, but in so far as the scattered results can be pierced together they indicate that inheritance is a far more complex problem in the apple than for instance in a plant like the sweet pea.

Structure and Fertilization of the Apple Flower.—Here it is necessary to look at the structure of an apple flower and the fruit to which it gives rise. Fig. 1 shows a section of the flower; there are the 5 sepals which persist in the eye of the fruit,

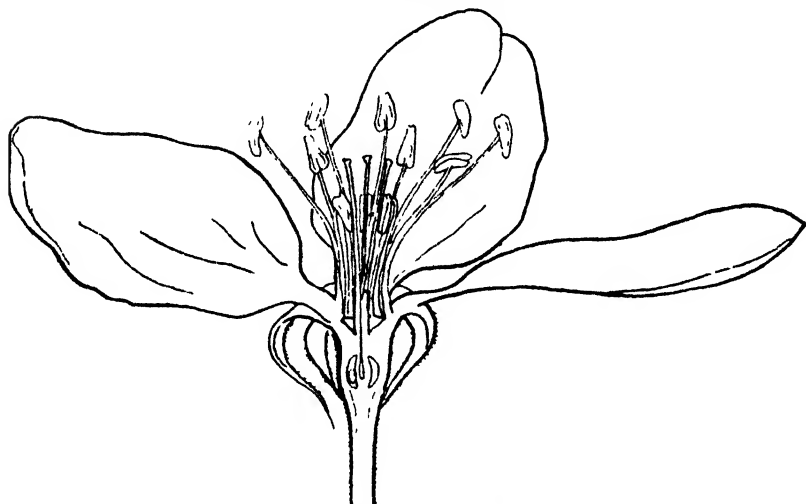


Fig. 1.—Apple flower in section.

the 5 petals, the 20-25 stamens, within which are the 5 stigmas, leading down to the ovary. The last is divided into five receptacles, each containing two egg cells. The pollen is ripe and shed a little before the stigma is receptive, so that as a rule the flower is not fertilized by its own pollen. But when bees and various other insects bring the appropriate pollen to the stigma the pollen tubes grow rapidly down the stigma, until they enter and fuse with the egg cells. If all the egg cells are properly fertilized there will be ten pips in the apple (Fig. 2). After fertilization the ovary begins to grow into the apple as we know it by the swelling of its outer fleshy covering. Many fruits that have missed fertilization, or in which the

development of the seed stops short, grow but a little way and then fall—causing the drop that is added to by apples which have been attacked by winter moth and the like.

Before leaving this process let me call attention to the fact that each of these seeds or pips is a new individual, compounded of the hereditary elements or characters derived from one or other parent. Each pip will give rise to a new variety, in the vast majority of cases distinct from both its parents and also from its fellow seedlings, though particular family identities can be traced. But when a new variety—a seedling individual—has been obtained, it can be multiplied indefinitely by vegetative propagation, in the case of the apple by budding and grafting, for few varieties of apple grow freely from cuttings. There are now millions of Cox's Orange Pippins in the world, but they must all be regarded as parts of that original raised by Mr. Cox in 1825, and they are all identical save for the very rare occurrence of a "sport."

Speaking broadly, fertilization is essential to the growth of an apple. It is not necessary that all the ten ovules shall be fertilized and mature as seeds; you will all be familiar with the fact that few of the apples you eat contain ten pips. In rare cases, depending both on the variety and on soil and season, a fruit will develop without fertilized seeds (a condition known as *parthenocarp*y), but from the practical point of view fertilization is necessary to ensure a crop.

Pollination Trials.—Let us examine a little more closely this matter of pollination. A number of trials have been made, some approximately and some under rigorous conditions of control, as by Mr. M. B. Crane of the John Innes Institution, on the efficacy of the pollen of different varieties in bringing about fertilization. It is found that apples, unlike the cherries and many plums, will normally "set" with pollen from other flowers of the same variety. The apple is generally self-fertile to some degree. The most notable example of self-sterility is Cox's Orange Pippin, and Table I, summarizing Mr. Crane's

TABLE I

			<i>Flowers</i>	<i>Fruit</i>	<i>Per cent.</i>
Cox's Orange selfed	..	..	1,950	13	0·7
Other varieties selfed	..	..	1,491	32	2·2
Cox's Orange crossed	..	..	941	53	5·6
Other varieties crossed	..	..	1,502	83	5·5

trials, shows how few are the fruits to be obtained from Cox's flowers which receive their own pollen. It shows also that other apples are more fruitful when crossed than when selfed. Not

a few cases have occurred of commercial failures to crop when Cox's has been planted in a block without admixture. Cox should always be interplanted with a variety like Worcester Pearmain, which flowers at about the same time.

Fig. 3 shows a photograph of an experimental tree of Cox. On certain branches the flowers have been pollinated with Cox pollen. They bear no fruit, whereas other branches, on which the flowers were cross-pollinated, bear freely. Why does Cox fail to set when it receives its own pollen? Careful examination shows that in such a case the pollen tubes begin to grow down the stigma, but stop at a certain point and never reach the egg cell. What may be the physical or physiological obstacle we do not know, though as we shall see later we can perceive an underlying cause.

So marked a case of sterility in apples as Cox's Orange presents is an exception, but there may be other latent causes of infertility in apple varieties which are usually masked because of the small proportion of flowers that need to be fertilized in order to produce a good crop. In a normal season an apple tree flowers abundantly, and if four or five per cent. of the blossoms mature into fruit there will be a heavy crop. Let us consider the seeds within the fruit, for seed production is the real measure of fertility; the number of fruits only measures fruitfulness when, as in the apple, an imperfect fertilization will result in a fruit. Table II shows the average of fruits and seeds produced by a number of pollinations in a particular year, first among what we shall for the present call normal varieties and then among three particular but well-known varieties, viz., Ribston Pippin, Blenheim Orange and Bramley's Seedling.

TABLE II

	<i>Flowers pollinated</i>	<i>Fruits set</i>	<i>Good seeds</i>	<i>Good seeds per fruit</i>	<i>Good seeds of flowers pollinated</i>
Normal varieties inter- crossed	1,740	109	313	3.0	18.0
Ribston, Blenheim and Bramley x normal pollen	279	19	30	1.6	10.8
Normal varieties x Ribston, Blenheim or Bramley pollen . .	354	23	4	0.2	0.5
Ribston, Blenheim, Bramley intercrossed	170	6	7	1.1	4.1

It is clear that these varieties, Ribston, Blenheim and Bramley, are highly sterile, either as seed parents or pollen parents. They are not less fruitful than the normal varieties, but they are approximately one half as fertile when seed formation is

taken as the measure of fertility. In the first place this may be correlated with the interesting fact that with these three varieties less than 30 per cent. of the pollen is "good," i.e., will push out pollen tubes when placed upon a suitable growing ground, whereas with the normal varieties 90 per cent. or more of the pollen is "good."

Cell Growth and Heredity.—Every plant is built up of cells which have all proceeded from the one original cell formed by the union of pollen and egg-cell. Within the cell is a small particle called the nucleus, and at the appropriate times this nucleus may be seen to contain a number of threads, about a fifteen-thousandth of an inch in length, called the chromosomes. For each species there is a definite number of chromosomes, and very often the number and to some extent the shape of the chromosomes is the same for all species of the genus. These chromosomes are all-important because they are the bearers of the hereditary factors and govern every character of the growing plant. One particular chromosome, for example, will determine whether the flowers are white or red, another whether the plant shall be tall or dwarf, etc. Growth proceeds by simple division of the cells, in which process the chromosomes split along their length and one-half of each proceeds into each of the daughter-cells. In consequence both of the new cells are exact repetitions of the old cell. This accounts for the identity with the original of all individuals produced by vegetative propagation, i.e., by cuttings, layers, runners, buds and grafts, and bulb offsets.

In the normal cell the chromosomes are in pairs, either identical or, if different, yet having the same function and governing the same characters in the plant, *homologues* as we call them. In the sexual organs of the plant, special cells are formed, by suppressing one member of each homologous pair of chromosome in a vegetative cell. Thus if we represent a 14-chromosomes-nucleus of a vegetative cell as AA BB CC DD EE FF GG, the nuclei of the pollen cells and of the egg cells will be A B C D E F G. Thus when sexual union takes place between two identical individuals, ABCDEFG of the pollen cell unites with ABCDEFG of the egg cell and a new AA BB CC DD EE FF GG, identical with the original parent cells, is reproduced. The cells with the double set are called diploid, those with the single set haploid. When sexual union takes place between different species or varieties (cross-breeding or hybridization) we begin with differences in one or more chromosomes of the parents. One may be AA BB CC

DD EE FF GG, and the other AA Bb CC DD EE FF GG, and consequently the new cell will be AA Bb CC DD EE FF GG, and the new plant will be hybrid as regards the characters carried by the B and b chromosomes. For example, BB may determine the flower colour to be red while bb makes a white flower. The hybrid Bb may have a pink flower, but very generally one or other of the chromosomes is dominant, and Bb will be red like BB. But the hybrid nature of Bb will come out in the offspring of Bb plants, because some bb plants will be produced and are white. This is the ordinary Mendelian segregation in the second generation into dominants and recessives in the proportion of three with the character of the dominant parent and one with the character of the other.

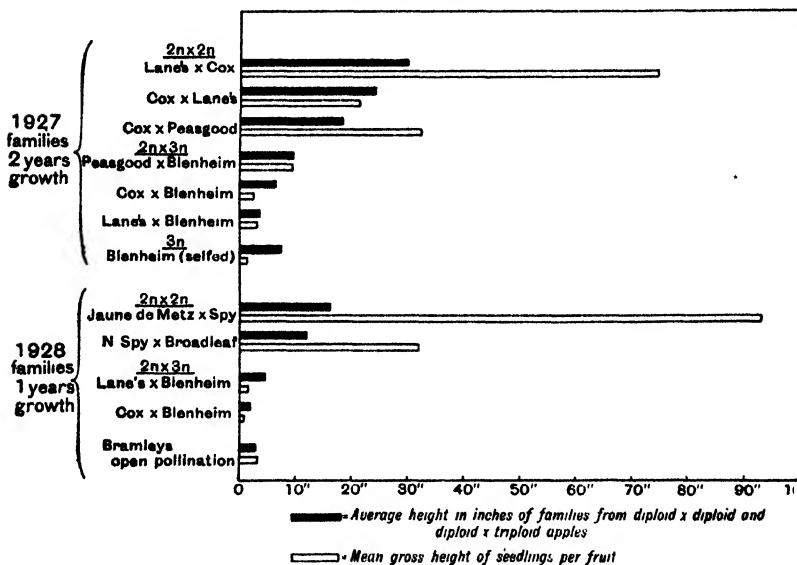
Such is the usual mechanism of the process of growth and reproduction, but very occasionally an abnormal cell is produced. For example, a vegetative cell will split its chromosomes and yet fail to divide, but remain as a cell containing 4 instead of the proper 2 sets of chromosomes. This cell then behaves like a typical diploid cell and gives rise to a shoot that has its chromosome sets doubled in both vegetative and reproductive cells. This shoot can be cut off and grown as an independent plant—really a new species, called a tetraploid, the double of the diploid from which it started. Such tetraploids are often giant forms of the original plant, because with the doubled number of chromosomes comes a larger cell and a plant larger in all its parts. The big *Campanula* "Telham Beauty" is a tetraploid of *C. persicifolia*, the giant Chinese *Primulas* are tetraploids, but this gigantism does not always accompany the tetraploid plant.

Again, tetraploids have in rare cases arisen through the union in sexual reproduction of two cells which have not undergone the usual reduction process into haploid cells. When a tetraploid breeds with a normal diploid the resulting hybrid will be a triploid with three sets of the type number of chromosomes.

The interesting point about these abnormal cells is that they are not infrequent, and among cultivated plants have indeed contributed to bringing about their economic value. Wheat and oats are hexaploids with six sets of chromosomes, and among the fruits such multiple structures are common and have caused many of the peculiarities in their behaviour which have hitherto been inexplicable. Such plants with various multiple sets of chromosomes are called polyploids.

Returning to the apples, it has been found that most varieties are diploids containing 2 sets of 17 chromosomes, but that a few are triploids with a total of 51 chromosomes in the nucleus. Among the triploids are those very thrice varieties—Blenheim Orange, Bramley's Seedling and Ribston Pippin—which possess a reduced fertility and give rise to fewer seeds whether used as male or female parent. These seeds, even when they will germinate, give rise to abnormal plants of very deficient vigour. Table III shows a comparison between diploid and triploid apples both as regards the number of living seeds per apple and the vigour of the plants grown from the seeds, measured by their height in their second year. The seedlings from the triploids are few in number and miserable in habit.

TABLE III



The photograph, Fig. 4,^F shows parallel rows in the nursery of such seedlings from triploids and diploids. The reason is plain enough now we are aware of the chromosome outfit. Seed formation is the outcome of sexual union, preceded as we have seen by a reduction division which halves the number of chromosomes in the cell. The halving consists in the selection of one member from each pair of homologous chromosomes, but symmetrical division becomes impossible when not a pair but a trio of homologous chromosomes has to be halved. When a diploid apple is crossed with pollen from a triploid, the egg

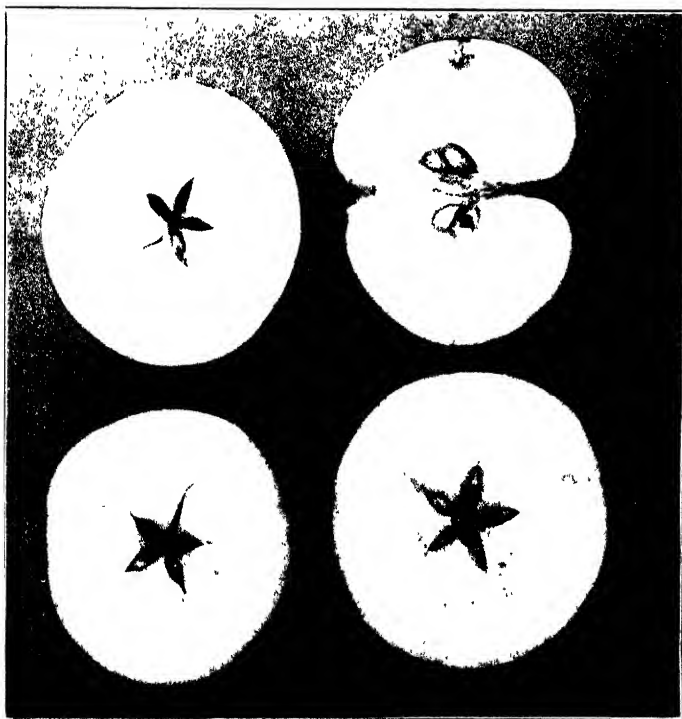


FIG. 2. — Apples in section, showing the structure of the fruit
RESEARCH AND THE BREEDING OF APPLES.



FIG. 3. — Experimental tree of Cox's Orange, branches on the left
crossed with Sturmer Pippin, those on the right selfed.

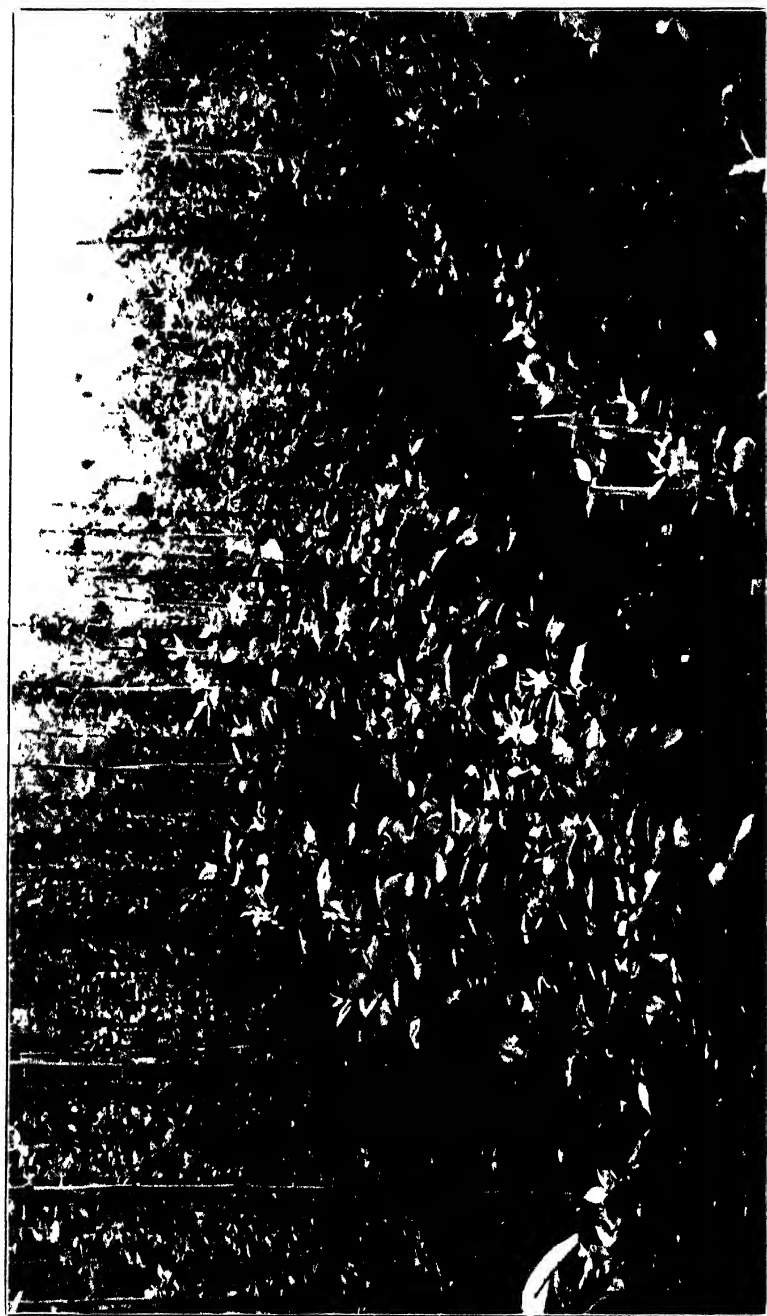


FIG. 4.—Nursery rows of apple seedlings, 2 years old. The row of tall plants on the left, and at the further end of the right hand row, are from normal diploids; the rest of the right hand row (dwarf plants) from triploids

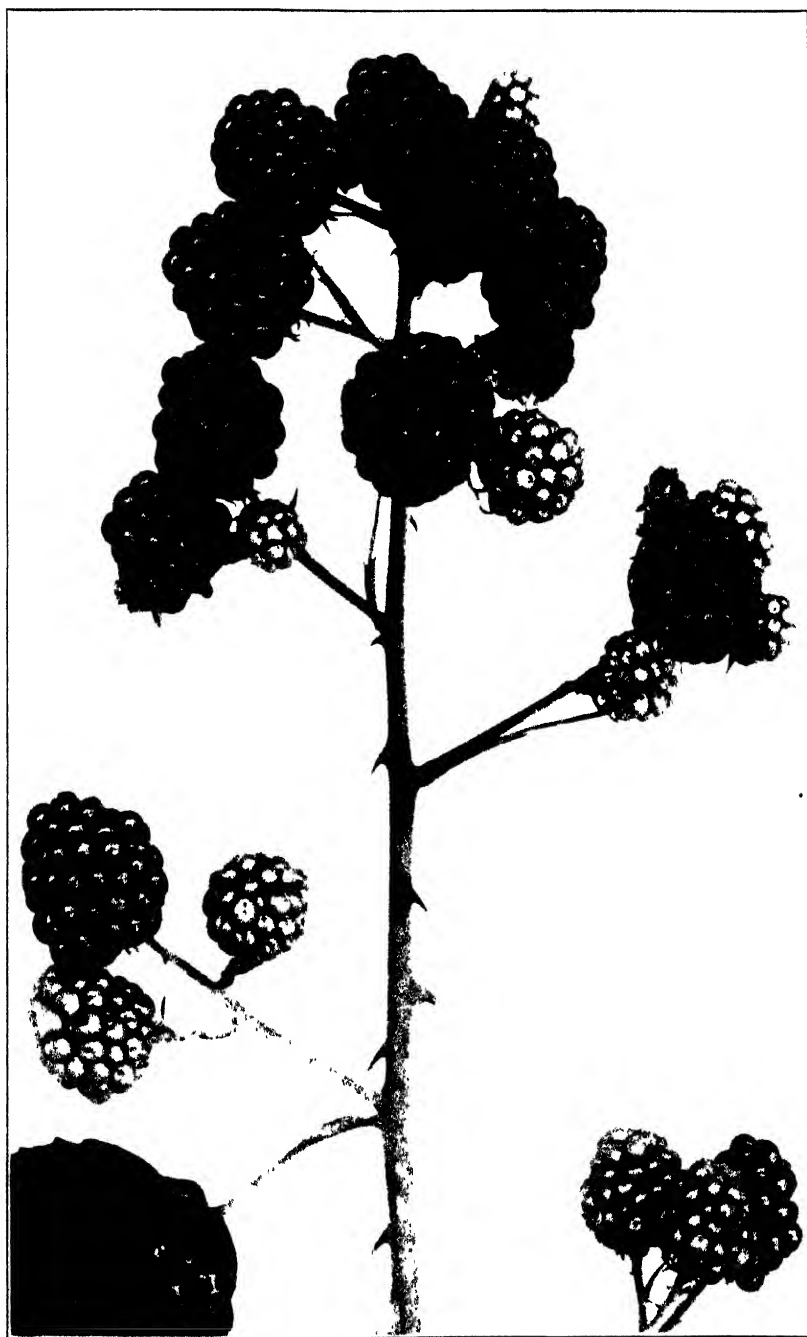


FIG. 5. - Seedling Blackberry, RT4.



FIG. 6. Spineless Seedling Blackberry out of RT1 selfed.

cell will contain the normal single set of 17 chromosomes, but the pollen cells will contain some irregular number obtained by the division of 3 sets of 17. So irregular is this division that only 30 per cent. of the resulting pollen grains are stable enough to grow, and, as we have seen, even the good pollen only succeeds in a few cases in making a viable seed.

A cell cannot survive and multiply unless there is a certain symmetry and balance among its chromosomes. For example, seedlings that are derived from two individuals of the same species are healthy and fertile. Each plant has contributed an identical set of chromosomes and the total complement consists of perfectly balanced pairs, represented as above by AA BB CC DD, etc. Crosses between varieties that differ but little, so that they may be represented by AA Bb CC DD, etc., are equally fertile. But many crosses between species which differ so much that they would have to be represented as Aa Bb Cc Dd, etc., fail to yield viable seeds, or if viable their seeds may in turn be sterile.

This sterility of the hybrid is often taken as a proof of the specific difference of the parents. The typical example is the sterile mule. The non-viability or sterility of the seed is due to the fact that the balance of the nucleus has been upset by the too great or too numerous differences existing between the homologous chromosomes contributed by each parent. It is only to be expected, then, that the irregular make-up which must result from the union of the single set from the diploid with the imperfectly halved set of the triploid will be such an unbalanced structure as to survive with difficulty, if at all. Thus we cannot expect to get seedlings of any value if we use triploids either as seed or pollen parents. It is on record, indeed, that apple breeders have failed when starting with Bramley's Seedling and Gravenstein, an American variety which now proves to be a triploid.

These conclusions regarding the triploid apples are greatly strengthened by the parallel but more extensive cases of polyploidy occurring among the cultivated Rubi. Here again we start with diploids—the common Raspberries and Blackberries, and we can get fertile hybrids between them. But some of the wild blackberries are tetraploids, among the most notable being the so-called Himalaya Berry, now being extensively cultivated. (There is no justification for the name, for it is a tetraploid of a species widely distributed in Central Europe.) The well-known Loganberry, of somewhat uncertain origin, is a hexaploid, again with an even number of

sets of chromosomes. By hybridization among these various complements, plants with odd numbers of sets of chromosomes have arisen, e.g., the "Mahdi" which is a triploid and the "Laxton Berry" which is a heptaploid. Now since the production of fruit in the Rubi involves the formation of a fertilized seed in each drupel of the compound fruit, it is easy to understand why all the hybrids with an odd number of sets—the triploids, pentaploids and heptaploids, are very much less fruitful than the diploids, tetraploids and hexaploids.

The plant breeder must thus avoid all matings that would give rise to an odd number of chromosome sets in his seedlings. Often, again, a tetraploid turns out to be more fertile than the diploid from which it proceeded; even a sterile hybrid may recover fertility if converted into a tetraploid. Among the first of the tetraploids to be discovered was that arising from *Primula kewensis*. That plant was a hybrid raised at Kew from two distinct species, *P. verticillata* and *P. floribunda*, and was perfectly sterile. But after some years one shoot was noticed to be bearing seed, and this seed turned out to be thoroughly fertile, so that it became the starting point of thousands of plants which are raised from seed every year. Now this fertile strain consists wholly of tetraploids. The original fertile shoot had arisen from a doubled cell and with the doubling of the number of chromosomes fertility had been restored. We can surmise that while in the hybrid diploid the dissimilarity between the chromosomes contributed by male and female may upset the balance, yet with a double number of such chromosomes a stable structure can be built up.

This restoration of fertility following upon doubling to a tetraploid is a matter of real economic importance, for though we cannot, except in a few cases, make tetraploids at will, we can arrange favourable conditions and be on the look-out for their casual production. An instructive example is afforded by the hybrid blackberry RT4 raised by Mr. M. B. Crane at the John Innes Institution. There exists a variety of one of the commonest blackberries, *Rubus rusticanus inermis*, a diploid with 14 chromosomes which possesses one good quality in that it is devoid of spines and prickles. Otherwise it is worthless, being practically useless for fruit production. In the course of numerous trials Mr. Crane did succeed in obtaining four good seeds by crossing it upon *Rubus thyrsiger*, another wild blackberry which, however, is a tetraploid with 28 chromosomes. Three of these seeds produced, as would be expected, triploid plants of no value, but in the fourth case a

very exceptional union had taken place resulting in a tetraploid. Presumably an unreduced nucleus of *rusticanus* with its full complement of 14 chromosomes had united with the normal reproductive half-nucleus of *thyrsiger* also with 14 chromosomes. The resulting tetraploid RT4 thus contains 28 chromosomes, being one complement of *thyrsiger* and two of *rusticanus*. With this doubling, the sterility normally found in such crosses disappeared. The new hybrid is exceptionally fertile and vigorous, indeed, in productiveness, size and flavour it is one of the finest blackberries known. RT4 is fully prickled (Fig. 5), because the spineless character is recessive, but being a hybrid it is still carrying the spineless character. A family of about 500 plants was raised from its self-fertilized seeds and among these 20 reproduced the completely spineless character of the original *rusticanus* parent (Fig. 6). Actually none of the spineless seedlings possesses the cropping power or quality of their RT4 parent, but seedlings are being raised from them, and it is only a question of time and perseverance before a variety will be produced combining spinelessness with the other qualities desired in a blackberry for general cultivation. By the fortunate accident of getting a tetraploid the sterility that was associated with the spineless character has been removed, and this fertility will persist in the new race.

The Special Case of the Apple.—With these examples in mind of the restoration of sterility in an unbalanced nucleus when the number of chromosomes is doubled we can return to the consideration of a point that had been left unexplained when discussing apple breeding. Blenheim Orange, Bramley's Seedling and others are triploids which cannot properly go through the division preparatory to sexual union, and this explains why they set few seeds, and those of little vigour. But if it only needs a little lack of balance among the chromosomes in the nucleus to render the cell inviable or sterile, how can these derivatives or triploids manage to live at all? The sorting into two portions of the three sets of 17 chromosomes which the triploid nucleus contains not only cannot be done but must introduce into the new nucleus an exceptional number of chromosomes that is not a multiple of 17. If the division and the subsequent reassembling are at random, the odds against the occurrence of a complement like either the diploid or the triploid are extravagantly great, and all other arrangements ought to be too unbalanced to live. Yet,

as we have seen, some seedlings from triploid apples do grow, even if in a weakly fashion; indeed, if we are to trust the old tradition, Cox's Orange Pippin is a seedling from the triploid Ribston Pippin.

The clue to this behaviour has recently been provided by the research of Dr. C. D. Darlington and Mr. A. A. Moffett at the John Innes Institution. They have demonstrated that the apple with its two sets of 17 chromosomes is already an irregular or derived polyploid. The apples and other Pomoideae with the basic chromosome number of 17 are themselves members of the great natural order of the Rosaceae in which a basic chromosome number of 7 is common. The 17-set of the apple is this 7-set of the Rosaceae order repeated twice in full and a third in part, so that the nucleus of the diploid apple may be represented diagrammatically as

AAA	AAA
BBB	BBB
CCC	CCC
DD	DD
EE	EE
FF	FF
GG	GG

and of the triploid apple as

AAA	AAA	AAA
BBB	BBB	BBB
CCC	CCC	CCC
DD	DD	DD
EE	EE	EE
FF	FF	FF
GG	GG	GG

Now obviously a stable structure is much more likely to be obtained from the division of such a group, in which there are only 7 different chromosomes each repeated 6 or 9 times, than of a group of 51 chromosomes in which there are 17 different ones each repeated 3 times. Indeed, we cannot regard as impossible the formation of a diploid group, as in the presumed origin of the diploid Cox's Orange from the triploid Ribston. Cox's Orange is an exceptional apple as evidenced by its self-sterility, and in all probability owes its peculiarities to some irregularity in its chromosome outfit due to its abnormal origin from a triploid.

The complex polyploidy of even the diploid apple that has thus been revealed serves to explain some of the difficulties that had been experienced by apple breeders. The characters

of the apple seemed only approximately to obey the ordinary Mendelian rules of inheritance. For example, when plants with coloured and colourless flowers are crossed the hybrid offspring are generally coloured, and their descendants when intercrossed reproduce the colourless forms in the proportion of one in four. But when green and red apples are crossed all shades are found in the progeny, some even more coloured than the red parent. Since, however, the chromosomes of the apple are

AAA	AAA
BBB	BBB
CCC	CCC
DD	DD
EE	EE
FF	FF
GG	GG

then if the chromosome A carries the colour factor and can be replaced in other varieties by its opposite number (a) without colour, the hybrid apple may have six grades of colour ranging from AAAAAA (full red) to aaaaaa (full green). Inheritance thus becomes a very complex affair, almost impossible to disentangle except by raising impossibly large families. None the less the new knowledge will be helpful to the apple breeder, even if it only prevents him from rejecting some of his results as amenable to no explanation.

Meantime this discovery that the Pomoideae are irregular polyploids derived from the main stock of the order Rosaceae is of great scientific interest because it indicates how the evolution not only of new species but even of new genera may proceed. How or when the exceptional nucleus with 17×2 chromosomes was built up from 7 basis we can never know, but we recognize that amongst the countless millions of cell-divisions some abnormal grouping happens from time to time. As a rule they perish, but once in a way a stable combination occurs and then a new species, even the starting point of a new genus, is born *per saltum*, by no gradual process of adaptation.

In this particular case we can surmise that the process began by sexual union between a diploid and a triploid of the Rose order. The diploid would contribute the normal 7 chromosomes, the triploid 10 as approximately half of its total of 21, thus producing a hybrid with a total of 17 chromosomes. This presumably sterile hybrid then had to double itself to create the original progenitor of the apple family. However, it is

extremely unlikely we shall ever be able to do more than guess at the order of events which led to the multiplication of the 7 chromosomes of the primitive Rosaceae into the 17 of the Pomoideae family.

One moral the scientific man may be permitted to draw from this story, and that is the dependence of practical economic investigation upon pure abstract research, seeking knowledge for its own sake. The study of the cell nucleus has been pursued for many years by scientific men in all countries without the least idea that it would have any bearing upon practice. It took a long time to arrive at a clear picture of the complex processes involved in cell-division and sexual union, but then it was discerned that the scheme corresponded to and explained the conclusions about inheritance that were being worked out by another unrelated set of investigators. Finally, from these separate sources emerges the fundamental theory which now guides the work of the breeder of apples.

* * * * *

FURTHER EXPERIENCES OF GRASSLAND MANURING

G. T. GARRATT.

IN the March, 1929, issue of this JOURNAL was given an account of an experiment in grassland manuring that I had undertaken in the previous year. It may, perhaps, be of interest to describe a further year's working of the system there described. The farm is on Boulder Clay, in Cambridgeshire, the typical "wheat and bean land" which is nowadays very difficult to keep profitably under the plough, and as a consequence this land is being rapidly laid down to what is often rather poor grass. In 1928, the method of nitrogenous dressings and rotational grazing had been tried on five plots of about $4\frac{1}{2}$ acres each, but in 1929 a sixth plot was added, partly because five plots had been shown to be insufficient, even in a normal year, and partly to try the effect of nitrate of soda. All the plots except Nos. 3 and 4 received a dressing of 4 cwt. of basic slag, which was applied early in December, 1928. Plots 3 and 4 had been rather better treated prior to the introduction of the intensive method, and they were also older grass land, having been laid down shortly before the War, while the other land was laid down between 1919 and 1921.

The early nitrogenous dressings were as follow:—

Plot 1.— $1\frac{1}{2}$ cwt. per acre of calcium cyanamide were applied on November 1, 1928. and a similar dressing at the end of January,

1929. A dressing of $\frac{1}{2}$ cwt. per acre was given after the first grazing on April 16.

Plot 2.— $1\frac{1}{2}$ cwt. per acre of sulphate of ammonia were applied at the beginning of February, and an equal dressing at the end of March, after a short grazing.

Plot 3.—Only one application of nitrate of lime was given. This was on March 19, 1929, before any grazing had commenced.

Plot 4.— $1\frac{1}{2}$ cwt. per acre of calcium cyanamide were drilled on November 1, 1928, and a subsequent dressing of $1\frac{1}{2}$ cwt. nitrate of soda was given on April 18, 1929, after the plot had been grazed.

Plot 5.— $1\frac{1}{2}$ cwt. per acre of nitro-chalk were applied early in March, and a second equal dressing in May.

Plot 6.— $1\frac{1}{2}$ cwt. per acre of nitrate of soda at the beginning of March, and the second dressing after grazing in April.

A smaller herd was run on the plots than in the previous year, there being only 11 cows in milk, and 13 "stores," all heifers. Three autumn calves joined them later. The usual rotational method was adopted. The cows had the first grazing of each plot, and were followed by the store cattle. As soon as the latter had got the grass quite short they followed the cows on the next plot, and the original plot was well harrowed, and would sometimes be given another dressing. In 1928, it was found that when grass was scarce, as during a dry July, the movement round the plots was too quick for them to have time to recover. It was hoped that this defect would be obviated by adding a sixth plot on which a quick-acting manure would be used.

It was suggested in the previous article that the weather was "an all-important factor" in the dry Eastern Counties; 1928, however, was a comparatively normal year. The year 1929 was abnormal and, even with an extra plot, the rotational system would not work according to plan. The cost of the nitrogenous manuring of grass land has to be recovered by getting (1) at least a fortnight's earlier grazing in the spring, (2) more "keep" than usual at the end of the summer, and (3) better quality grass from the beginning of July onwards.

In 1928, most of these expectations were realized, though two periods of drought made it difficult to dress the fields regularly after July, and the system had to be abandoned in August. There was, however, useful grazing by March 20, which was a fortnight earlier than on neighbouring farms, and there was extra grazing for about three weeks in the autumn. The remarkably fine condition of the stores in October was evidence of the quality of the grass.

In 1929, the weather upset plans from the first. February and March were exceptionally cold, and the ground was

frost-bound until the middle of March. The cows were actually let out on to Plot 2 by March 23, but they found little to eat, and the other plots were so backward that it was useless to start a rotational system. The only field with any real "keep" for the first three weeks was one outside the experiment, which had been dressed with farm-yard manure during February, and was intended for hay. After a few days on each plot, and a week on the hay field, the cows started again on Plot 2 about April 24.

What should have been the second round of grazing was now upset by the grass growing too fast. A fortnight's warm wet weather produced a very rapid growth, and ultimately it was found necessary to shut off Plots 1 and 3, and cut them for hay. They were both closed in May, and mowed on July 4, when they yielded a light crop of just under 1 ton per acre. Between June 4 and October there was only one shower of rain, and this made a double difficulty. By the end of July, all the plots were either mown or eaten short, and the ground was so hard and dry that it seemed useless to continue the nitrogenous dressings. The water supply in some of the plots also became precarious, for it was dependent upon ponds, and these ran dry for the first time in the memory of anyone working on the farm. It became impossible, therefore, to continue either the dressings or the rotational system, and the cows had to be allowed a free range. They certainly managed to keep up their condition and milk yield from grass which seemed to be cropped right down to the ground, but it was impossible to attempt any quantitative estimate of the feeding value of the different plots. Probably, only in very favourable years would any exact comparison be possible, and the writer can give only the following rough impressions from the two years' working.

Conclusions.—(1) In the drier counties it is not practicable to work on any definite system throughout the summer. After May, it is probably unwise to rely on rainfall or ground moisture sufficient to justify periodical dressings of nitrates. It is, however, useful to keep cows and stores moving round the plots, harrowing vigorously after the latter have left.

(2) After a very cold winter, a field dressed with fairly "long" farm-yard manure, even as late as February, will give an earlier "bite" than any artificial manure, presumably because of the mulching effect of the straw.

(3) Cyanamide, even when applied in November, cannot

be relied upon to give an early result in the spring. Dressings, as described above, on Plots 1 and 4 had a very marked effect as soon as the weather got warm, but to get results "up to time" a quicker-acting nitrate is needed. It should, however, be pointed out that on both plots the two years' treatment has had a very beneficial effect on the herbage.

(4) Sulphate of ammonia seems to give the quickest growth, with nitrate of soda a very close second. The nitro-chalk plot appeared to be very palatable.

(5) It is probably uneconomical to apply quick-acting manures in the spring to more than two plots. This should give the fortnight's extra grazing, which is as much as can be expected in the Eastern Counties. On heavy soils it is likely that the soft state of the land will make it undesirable to turn out cows too early. The alternative method, of treating all the plots and, if necessary, cutting one or two for hay, does not seem very satisfactory.

(6) If a farmer intends to use the intensive method in order to run a considerably larger head of stock than usual, it would certainly seem advisable to grow some arable crop which can either be turned into hay or fed green.

(7) It is probably best not to run too many cows on the plots, but to keep the store cattle as the variable factor, regulating the number which follow the cows so as to be able to clean up well after the cows have moved on. The plots, even in 1929, provided enough grass to keep the cows well up in their yield. The cows received no cake until the end of September in either year, but the year's average for a non-pedigree Shorthorn herd was 880 gallons the first year and over 830 the second. The store cattle also kept their condition very well.

(8) After June, it is best to take advantage of any wet spell to apply some quick-acting manures, instead of working on the proper rotation and relying on periodical showers.

(9) If any portion of a plot is inclined to grow rank it is worth while running a mower over that part. If the rotational system is working well, both cows and stores get rather fastidious. It was found that certain parts of the plots were left, but once cut the cattle would begin feeding evenly again.

(10) The writer feels that if the system is to be economically sound the nitrogenous dressings must never be used to push on the natural spring growth, but only to make an artificial growth for a short time before, and for a longer period after, the normal spring flush of grass.

THE IMPROVEMENT OF FARM LABOUR AND ITS MANAGEMENT BY EDUCATION

W. R. DUNLOP.

1.—Introduction.—For several years past the writer has carried out investigations in connexion with the efficiency and welfare of farm labour, in the expectation that it might be possible to effect readjustments and improvements on farms, to the benefit of both worker and employer, as has been done with notable success in industry and commerce. For example, it was considered likely that by closely analysing the work of each man on any farm it might be possible to show him how to save time and energy; by studying tools and appliances and the lay-out of fields and the interior of buildings to effect labour-saving adjustments; by studying the question of incentive and farm "relations" to introduce new systems of payment, etc., and by means of scientific selection to aid the farmer in securing men particularly suited for certain jobs or conditions. While investigations along these lines in different parts of the country have shown that there are possibilities,* it has been found that on account of the inherent nature of agricultural activity and conditions, improvements can only be introduced *gradually* and at the right time, and then only (except in highly technical matters) by the farmer and the worker making such improvements for themselves. Even then it is not by isolated and necessarily tangible adjustments that labour and its management is to be improved. It is more a question of keeping the efficiency idea steadily in mind and letting it consciously, and even unconsciously, influence every action and thought during the year's work.

Thus, the writer has come to take the view that it is *education* that is needed; that the thing to concentrate on is the individual rather than the work, and to try and create in both farmer and worker the right attitude of mind towards both labour efficiency and other equally important aspects of scientific management. This, in the writer's opinion, cannot be achieved merely by the experimental demonstration of

* Report on An Investigation of Certain Processes and Conditions on Farms: W. R. Dunlop (National Institute of Industrial Psychology, London, 1927).

Report of Efficiency Investigations in Connexion with Farming: W. R. Dunlop (Ministry of Agriculture, 1928).

Industrial Psychology and Agriculture: W. R. Dunlop. (See *Industrial Psychology*, Home University Library, 1929.)

Report on Efficiency of Sugar-beet Lifting: W. R. Dunlop (Investigation carried out for the late Hon. E. G. Strutt, not published).

improved adjustments, even under commercial conditions. Very often there can be nothing *visible* to demonstrate. In any case, adjustments that may be good for one farm may be quite unsuited to another. It is mental training in principles and ideas that is needed, though of course research and investigation are absolutely essential in order to secure the necessary facts and methods of procedure, and for testing new educational notions.

The purpose of this article is to suggest what this education for the improvement of farm labour and its management should be ; to enumerate the main topics and ideas in which instruction should be given ; and to illustrate these by means of examples drawn from research in the field. Before proceeding with this task, however, four important facts must be noted.

(1) First, it must be emphasized that any attempt to educate the worker, which in the present instance is the primary aim, must be accompanied by a similar and simultaneous effort in regard to the farmer. One without the other, from a practical point of view, is useless. All that is put forward in this article is, indeed, intended as much for the education of the prospective farmer as the prospective worker.

(2) The second point is that educability sets a limit to the effectiveness of education. There must be capacity and willingness to learn as well as opportunity to learn. The kind of education in view, however, is of such a character that only those who are actually mentally or temperamentally defective can fail to benefit to some extent ; while anything in the nature of "over-education" is strictly guarded against.

(3) The third point is that the existing and relatively low level of wages and limited scope of advancement in agricultural work does not render any attempt at the better education of the worker futile. Actually the kind of education in view is *one* of the only things that can better matters in this respect. In any case, there must always be agricultural workers for society to exist at all, and an attempt to train and educate them scientifically is obviously desirable and to the public good.

(4) The fourth and final point to be noted is that education, like farming itself, is a very slow business and takes time.

2.—Education before Employment.—The study of labour on farms has shown that, quite apart from mental capacity, the attitude of mind is usually entirely unsatisfactory for educational work. Something, no doubt, can be done with

the younger men, and attempts are being made by the writer to test possibilities in this direction; but the most hopeful and scientific procedure is to begin with the child at school.

The first essential is vocational guidance in the rural, and possibly in the urban, elementary schools. In order to find out which boys (and girls) are best suited for agricultural (including horticultural) pursuits, it is first desirable to know exactly what qualities of mind, character and physique different agricultural pursuits call for. To secure this information jobs must be analysed: that is to say, work and working conditions must be closely investigated and the muscular, sensory, mental and temperamental qualities needed carefully enumerated and checked by one or more persons familiar with the work and capable of giving a truthful and unbiassed opinion. Agriculture really consists of about 12 entirely different kinds of occupation, ranging from corn growing to poultry farming, and from glass-house work to sheep farming. All require certain common qualities, but each one also calls for certain special qualities—to a much greater extent than is usually realized. It is not so much a question of skill as of suitability. The amount of “skilfulness” required in farm work is often greatly exaggerated.

To pursue the idea of vocational guidance, the next procedure is to select those children who appear to be well suited for agriculture and special branches of agriculture, and to test their response to the vision and intelligent explanation of different jobs in progress under actual economic conditions. An attempt is being made to do this by means of carefully planned “farm classes” on farms where the work is carried out efficiently under decent conditions. The object is *not* to try and entice the child into agriculture, nor to teach the child an agricultural job. The object is merely to introduce the child to and familiarize him with the worker and his work (under decent conditions), in order to see if this arouses any interest and desire. The object is certainly to create an impression of the value and interest of agricultural work and to show that it is not to be despised, but otherwise it is entirely a matter of studying responses to stimuli.

It will be realized that work along these lines is essentially different from school gardening, etc.—work which is useful, but of limited value from an educational point of view.

3.—Education during Employment.—The foregoing plan refers to children of 11 to 14 years, or possibly younger. It presents few practical difficulties owing to the existence of

control. It is educational effort between 14 and, say, 18 that presents the greatest difficulties, and yet this is the period, and probably in most cases the only period, during which there is any hope of educating and training the worker. More serious still, it is the period during which, without continuation classes, the effects of even good elementary education are largely lost owing to the irresistible competition of money, sex, sport, dress and other "interests," including the "pictures." In Germany continuation classes are compulsory: in England, and with special reference to agriculture, everything depends at present on securing some measure of constructive co-operation between parents, the educational authorities and the farmers. Farm institute training, even if it were in every way suitable, is not, and probably never will be, available to the masses. The education and training of the average farm worker must be carried out somehow on the farm. We now see one of the reasons why it is so important for the farmer himself to be well educated. As well as being a farmer, he is asked to be a bit of a schoolmaster.

Reverting to the fundamental notion of vocational guidance, the ideal would be for the elementary school to recommend a suitable boy to a suitable farmer, and if a job were offered and accepted there would be an understanding, in writing, between the parent and the farmer in regard to wages, continuity of employment, education and prospects—not legally but morally binding, and, of course, in every way reasonable to both parties.

It is, of course, unnecessary, and indeed undesirable, that the farmer should be totally responsible for the education and training. Continuation classes for instruction in certain topics could be arranged at the nearest village school, and possibly more might be done in certain cases by means of correspondence classes and visiting instructors; but the farmer would have to help and insist on regular attendance.

From the economic point of view one great difficulty in the way of any such arrangement would be the question not so much of immediate wages as of prospects. This matter will be dealt with later. It may be mentioned here, however, that it is very important to know how long it should take to train a general or specialized agricultural worker, and more important still, at what age he can be regarded as sufficiently responsible to be relied upon. It is this *reliability* which is so important in agricultural work. Unless the time limits which most farmers regard as necessary can be greatly reduced

the chances of improving labour by education or anything else are very much minimized. No intelligent and energetic boy can be expected to wait willingly until the age of 30 to become a shepherd or a cowman with only 42s. per week. As will be emphasized later, prospects on the farm could be greatly increased by pensioning the aged workers, who at present are far too numerous. There is the further question, also, as to whether change of position may not be desirable for purposes of gaining wider experience. Here one must distinguish between change of job and change of occupation. The former may be desirable; the latter is not desirable, but by no means infrequent in connexion with agricultural work. We need to know a great deal more about the causes and circumstances of these changes.

For the present, however, we are concerned with education itself on, or associated with, the farm. The important thing to decide is what the nature of this education and training should be. At the outset it must be recognized that the average boy who takes up farm work under existing economic conditions will nearly always have a rather low standard of general intelligence, probably not above the normal for 11 or 12 years. The instruction would, therefore, have to be simple and very elementary, though this would not detract from its having a very important educational influence. What we are after is not so much to impart knowledge as to create the *right attitude of mind*.

In order to afford some idea as to what the writer considers the education and training should be, we may take, as an example, a boy who is intended for a cowman, and starts as a milker on a good Grade A herd. Obviously his first task will be to learn to milk. There are good and indifferent ways of milking and of learning milking, and this should receive close attention. Coming now to what is more strictly educational, the boy might be shown, during his first year, how time can be saved by avoiding unnecessary movements, and in having the right thing in the right place; the meaning of being methodical and thorough; something about different breeds, foodstuffs, feeding and appliances; sterilization and cleanliness; and the importance of kindness to animals. In his second year elementary facts of parturition in the cow might be given, and symptoms of disease and particularly ailments; elementary facts concerning lighting and ventilation in relation to cowsheds; herd management in different districts and different countries. During the third year the most

important of all educational effort would be made, namely, to explain the economics of wages—how wages depend on costs, revenue and yield; the advantages of piece work; and the relations that should exist between farmer and worker. Above all, an attempt should be made to develop keenness and “open-mindedness” in regard to new methods and ideas, and an appreciation of just and constructive criticism.

The foregoing indicates in a very general way the kind of instruction that might be given to the young specialized worker. More often than not, the young worker would be engaged for general work on a farm. In this case the instruction—particularly the technical instruction—would also be general, *i.e.*, less specialized. More attention would be given to implements and machinery and their care and adjustment, the cultural requirements of different crops, and so on. The most important instruction, however, would be that which has regard to efficiency and economy of labour, and the relations that should exist between farmer and worker. It is important to note that in the case of the general worker vocational guidance is not completed. The *occupation* has been chosen (*i.e.*, agriculture), but not the *job*. It is necessary that the vocational guidance authority should keep in touch with the young general worker. It is true that he may not wish to specialize, or may not possess the requisite natural qualifications: but specialization is to be encouraged if possible on grounds of increased earnings and efficiency.

In addition to all this it is desirable that the young worker should be made thoroughly familiar with all possibilities of advancement in agriculture: small holdings, emigration, supervision (foreman's work) and even managerial work. The ability, risk and responsibility which these involve, however, should be explained.

4.—The Efficient Utilization of Labour.—The greatest education (and satisfaction) which the worker can have is to see and realize that his labour is being efficiently and considerably utilized by his employer, to their mutual advantage. In order that labour may be utilized with the utmost efficiency in farming it is necessary to give definite and constant attention to a number of important points and principles. It is highly important that a young man who is going to be a farmer or farm manager should receive instruction in these principles. We have already prescribed the germ—which is efficiency with fairness—in the instruction of the

worker. We now have to develop this more fully and in greater detail for the information of the prospective employer.*

(1) *Knowledge of the Social Sciences*.—To provide the necessary intellectual background for efficient administration in regard to the more practical matters which follow, it is desirable that the prospective manager of farm labour should acquire some knowledge of the elementary principles of ethics, economics and industrial psychology, and some knowledge of industrial history and geography.† Any reasonably educated person can obtain a satisfactory introduction to these subjects by the careful reading of one or two small popular works such as *Supply and Demand*, by H. D. Henderson, and *Industrial Psychology*, edited by Dr. C. Myers.

(2) *Seasonal or General Unproductive Time*.—One of the biggest problems in most branches of farming is to find a way of reducing unproductive time, or time not altogether economically utilized, caused by bad weather, "waiting for things to grow," etc. This form of waste can only be overcome:—

- (a) by carrying a smaller number of permanent hands and employing seasonal labour (nowadays often very difficult and unsatisfactory); or
- (b) by carrying a full staff (adequate for the busiest periods) and devising profitable (*i.e.*, revenue-yielding) work during the slack periods. This also presents difficulties.

It will be sufficient to mention here that the problem is being investigated, and that it is hoped, in connexion with (a), to effect improvements at the Labour Exchanges, and in connexion with (b) to try the experiment of a farm "industrial section." Educationally, it is most important that labour should realize that seasonal unproductive time, especially in arable farming, is a serious problem affecting wages and profits alike.

(3) *Job Unproductive Time*.—This form of unproductive time is that proportion of the total time of actual operations in the field or buildings which may be said to be wasted. Necessary rest to eliminate or prevent fatigue (either physical or mental) is *not* unproductive time. Unproductive time can be lessened or tend to be lessened by giving attention to (a) the improvement of lay-out, (b) the prevention of unnecessary stoppages and delays and (c) good routing and transport.

* The majority of points (those marked †) should also be instilled into the mind of the worker. Many of these are to be regarded as included in the instruction of the worker (*see* Sec. 3).

† An exact acquaintance with agricultural conditions abroad is most important.

- (a) Occasionally the shape of a field can be economically improved or two small fields thrown into one. Experiments in this country and in Germany have shown a considerable saving (by reducing turning, etc.). The position of gates can sometimes be economically altered. Improvement of the internal lay-out of buildings is also possible, *e.g.*, in horticultural and egg-packing sheds, cowsheds, milk-rooms, etc.
- (b) †Low earnings amongst women topping sugar-beet on piece work (and consequently slow clearance of the crop) have been shown by the writer to be due to excessive talking. In potato hoeing by a gang of men on day work 15 per cent. unproductive time was measured, after allowing 15 per cent. for resting. This was due to stoppages caused or accompanied by talking.

Breakdown of implements and machinery is well known to be a common and often very serious cause of delay. It has been observed by the writer in regard to the self-binder, thrashing machine, grass-mower, hay-tedder, potato-digger, sheep-shearing machine, and, of course, tractors. In some cases it has been due to definitely faulty manufacture, but usually to lack of systematic overhauling.

Planning ahead includes letting the workers know in advance what their next job is to be, or likely to be; calculation and arrangement for what is needed, *e.g.*, adequate number of receptacles such as sacks in potato harvesting.

†Organization and "flow" are important points. In haymaking, for example, where there is both a carrying and a stacking gang, the rate of work should be well balanced. In the harvesting of potatoes the pickers must be able to keep pace with the tractor, and *vice versa*. One or more indifferent workers in team work may and often do upset the whole operations.

Delays and stoppages can sometimes be prevented by intelligent anticipation of change in weather. Apart from making his own observations, the farmer should carefully study each morning the official weather map (published in *The Times*). As an illustration it may be said that on a certain farm, during definitely unsettled weather, one morning was fine. Rain was expected, and arrived in the afternoon. Two jobs had to be done: some cattle "drawn" for market in the pasture, and wool packed in the barn. The wool was packed in the morning when the weather was fine, and the cattle "drawn" in the afternoon in the rain, heavy enough to interfere with the work: by no means a satisfactory arrangement.

- (c) †Delay in getting from one job to another is often a cause of much time being unproductive. The only remedy lies in education and incentive.

It is important for several reasons that farm workers, particularly those in charge of live stock, should live close to their work. In one instance (in Oxfordshire) a waggoner was found to be living three miles away from his work. On the other hand, there are social advantages in living in or near a village, *e.g.*, getting the children to school. Generally, however, it is desirable for cottages to be within easy distance of the farm.

†Shepherds, stockmen, poultrymen, etc., do not always take the shortest routes in the execution of their duties.

This has been observed by the writer in relation to egg collecting and pig feeding.

†As much as possible should be done on a single journey. Poultrymen have been observed to waste unnecessary time and energy through not combining two operations on one journey. A shepherd on his round may forget to take something for which he will have to return.

†Defective methods and arrangement may often be observed in connexion with the carting of sugar-beet and potatoes. The unproductive time of one of three men loading sugar-beet was found to be 50 per cent. through the rows of heaps being so close together that one row had to be straddled. The quickest method of shifting potatoes (main crop) is the Isle of Ely method, in which the carter throws 30-lb. basketfuls to a lad in the cart while it is in motion. Wheelbarrows have been observed in use for food transport on poultry farms when a small two-wheeled cart would have been more economical.

† For communication in the field it is certain that semaphoring would save time and energy on many occasions. It would do the farm worker good educationally to be taught to semaphore. Normally, however, it is desirable that the farmer should give his orders orally.

(4) *Productivity of Productive Time*.—†Productivity of productive time really refers to *rate of work* in respect of some centrally productive process. For instance, the rate at which a man actually milks a cow or shears a sheep or pulls up sugar-beet. It is a fundamental principle that *quality of work and reasonable comfort must never be sacrificed in endeavouring to obtain a faster rate*.

- (a) The young novice must be given adequate instruction as to how to do a certain job from the very start (*see* Section 3). Nervousness must be dealt with sympathetically.
- (b) † There should be regulation and wise application of energy. A steady pace is required, not dashing work. Most jobs have a rhythm and this should be "caught." Rest pauses should be taken, if possible, during enforced unproductive time, *e.g.*, at the headlands, in cultivation work. Wherever possible the worker should ride rather than walk. In ploughing the worker should not lift the plough in turning more than is necessary: the horses can pull it round. When two or more men are on a single job involving different processes they should periodically change over.
- (c) † Waste movements should be eliminated, and correct movements insisted on. This is extremely important in fruit and hop picking.
- (d) † Defective tools and appliances are often responsible for a reduction in the productivity of productive time. They not only have an undesirable physical effect but may cause mental irritation, especially if the worker is on piece-work. Instances have been observed of defective dipping tanks for sheep, shearing machines, scrapers for cleaning out poultry manure, bags and receptacles, knives for chopping sugar-beet, etc.
- (e) † Much can often be done to make work easier and therefore to increase the rate (or make an increase possible) by

devising or adopting mechanical aids and substitutes. The employment of a "couch" in the trimming of sheep is a typical example; also the use of a mirror on a tractor to save the driver from continually turning round.

- (f) † Bad adjustment of machinery and implements is often a serious cause of slow and inefficient work. Instances observed include badly set sugar beet lifter, bad adjustment (only requiring new washers) of a double Cambridge roller, and handles much too high in a disc horse hoe.
- (g) † The provision of the *optimum* lighting and ventilation in cowsheds, stables, food-mixing sheds, brooder houses, etc., is highly important, not only for the workers but for livestock. In spite of official regulations and expert opinion, very little is known as to what exactly is desirable. Photometer and Kata-thermometer measurements made by the writer have yielded interesting results, not only in buildings but also in the field. As regards clothes, there is no doubt that the worker's garments and footwear are not always as suitable as they might be.
- (h) † Although taken last, incentive is by far the most vital factor affecting rate of work. It brings us back to the old question of wages, the importance of which has been fully realized throughout this article. The essential thing for the prospective farmer to grip is the importance and possibilities of piece-work payment and of bonuses. Even with labour what it is, the majority work better where piece-work and/or bonuses can be arranged. When the educational standard of the farm worker has been raised it is likely that piece-work and bonuses will become general. Much remains to be done in devising more scientific methods of fixing rates of payment. Money, however, is not the only incentive on the farm. Prospects, pride of work, interest in work and loyalty to the employer can and should be important motives. This brings us to the final and highly important question of relations between farmer and worker.

5.—Relations between Farmer and Worker.—Many writers on social and economic questions (who are sometimes unacquainted with practical realities) would be tempted to discuss this question at considerable length. Not only in the present instance is such a course prohibited by lack of space, but it is actually unnecessary. All we need to do is to enumerate those points concerning which we should like to see a more explicit understanding as between farmer and worker on every farm. The main points are that:—

- (a) Labour has the right to expect the farmer to farm efficiently.
- (b) The farmer should settle grievances and disputes judicially and scientifically.
- (c) He should aid the advancement and education of his workers.
- (d) He should give the best possible attention to the question of housing and to making work and conditions easier.
- (e) He should encourage suggestions.

On the other hand, labour must

- (a) "Pull its weight" and obey orders willingly.
- (b) Work conscientiously and well.
- (c) Be responsive to new methods and ideas.

- (d) Realize the farmer's difficulties and responsibilities, and that wages are a first and very serious charge on revenue.
- (e) Understand that "minimum wage" is not intended to mean the "minimum amount of work," and
- (f) That higher wages can only (and in future will always) accompany more profitable farming.

There is one final point to be considered : the effect of an "efficiency policy" on unemployment. There is first the case of the aged worker who is incapable of strenuous work. Many such men are retained on farms partly for humanitarian reasons and partly because younger men are often less reliable and generally less experienced. It seems legitimate to hold, and to teach, that it is unsatisfactory that this should be necessary. In general, agriculture cannot afford to retain either superfluous or incapable workers, nor should it be expected to. The case of the former can only be met by expansion ; the latter presents a purely social problem.

6.—Summary and Conclusion.—In this article an attempt has been made to suggest the kind of education which should be provided for the young worker and prospective farmer in order to improve labour and the efficiency of its work on the farms of this country.

As regards the better education of the worker, it is considered necessary to begin with the child at school. By means of vocational guidance, based on job analysis, individual child study and farm classes, it is believed that more children of the right type could be led, without coercion, to take up and enjoy agricultural work *under decent conditions*. The importance of instruction during the early years of employment is emphasized, and a sort of apprenticeship, involving education and training on or in association with the farm, is suggested. The nature of the training and education is explained, the main object being to ensure that the young worker shall be well informed in regard to his job and to enable him to advance as far as his abilities and the conditions of agriculture permit.

Since the efficiency of labour must always be largely determined by the methods of management, the education of the prospective farmer is no less important than that of the worker. One is in fact useless without the other. Under the headings of Seasonal Unproductive Time, Job Unproductive Time, Productivity of Productive Time, and Relations between Farmer and Worker, an attempt is made to compress into small compass the kind of information regarding labour management that should be instilled into the mind of the pro-

spective farmer. Many of the points should also be specifically included in the instruction of the worker whenever it is possible to do so. Throughout the article it is made evident that the main objective is to create, in both farmer and worker, a new attitude of mind rather than to load the mind with a mere assembly of facts.

The effectiveness of the kind of education outlined is about to be tested. It is, however, highly necessary to realize that education in labour management constitutes only *part* of what should be the farmer's education for management. There is the working of the farmer's mind, and the knowledge required, in relation to *everything* to be considered: we need to know exactly what his education in its *entirety* should consist of—and how he is to get it. This at present is not definitely known. It is the problem which the present writer is primarily interested in, and which is being investigated at the South-Eastern Agricultural College, Wye, with some considerable prospect of success.

* * * * *

FERTILIZER TRIALS IN 1929

H. V. GARNER, M.A., and J. WISHART, D.Sc.,
Rothamsted Experimental Station.

IN continuation of the programme of fertilizer trials carried out on ordinary farms by the staff of the Rothamsted Experimental Station, of which an account was given in a previous issue of this JOURNAL,¹ a further series of trials was arranged in 1929. As was indicated in the last report, experience has shown that it is possible to lay down experiments of the modern randomized type on private farms in various parts of the country, and to reach results of an accuracy comparable with that of the trials regularly made at Rothamsted and Woburn. There are obvious advantages in repeating the same trial at a number of centres, where the variety of soil and climate combine to throw light on the specific points tested in a way that is not possible at a single centre. The experiments are of two kinds: (a) those in which direct contact is observed between the Rothamsted Staff and the farmer, and in which the experiment is laid out and carried through from Rothamsted, and (b) those in which the co-operation of County Organizers, of the staff of Agricultural Colleges, and in some cases of private individuals is secured, and while the scheme of trial and general lay-out is provided by Rothamsted, the complete management

¹ For references see page 802.

is left to the individual concerned. The authors wish to record their deep indebtedness to the several authorities and individuals who have co-operated in this way. Their names, and those of the farmers who have assisted us by the provision of sites and labour, and whose co-operation at all stages has been most valuable, are given in the reports which follow.

The experiments are mostly of the Latin Square type, in which there are as many replications of each treatment as there are treatments, while each treatment occurs once and once only in each row and column of the square. Two experiments in 1929 were, however, of the randomized block type, a type which is suitable when it is desired to test all possible combinations of a number of treatments, and where owing to the larger number of treatments economy dictates that the number of replications shall be fewer than the number of treatments.

Use of the Standard Error in the Summaries of Results.—

The nature of the general significance of the results of an experiment is determined from statistical examination of the yield figures, the details of which are too technical to give in full, and the statements as to the results of the trial are based on this examination. A figure giving the "standard error" of the mean yields for the respective treatments is, however, added to the summaries of results which follow, and the usual criterion for significance is that a difference between two mean yields should be equal to three times the standard error given in the table. When once the effect of the treatments has been shown to be definitely significant, therefore, individual differences may be examined in the light of their standard error, but it should be pointed out that this is not the only test applied, and in particular that certain differences may exceed the limit set for significance even although the effect has not been proved beyond question to be real by the fuller analysis which has been carried out. On the other hand, a definite progressive rise in yield due to the application of increasing quantities of fertilizer may be satisfactorily demonstrated even although not all adjacent differences are as much as three times the standard error.

Basic Slag on Meadow Hay.—At the farm of Mr. B. W. H. Pratt, Brooke, Norfolk, the effects of three types of basic slag, of different solubilities in citric acid, were tested on hay in the fourth season. The experiment was a 4 by 4 Latin Square with $\frac{1}{4}$ acre plots. The soil is chalky Boulder Clay. The results of 1926-28 had shown that the effectiveness of the slags lay in the order of their citric solubilities, and that the observed

differences between the yields produced by the various types were significant. In order to maintain the yields and bring out the phosphatic effect, a basal dressing of 1 cwt. of sulphate of ammonia and 2 cwt. of 20 per cent. potash salts per acre was given to all plots in early March, 1929. Owing to the very dry season which followed, this dressing was probably inoperative, for the crop only amounted to 13 cwt. on the average.

The yields for 1929 and also for the full four years of the experiment are given in Table I.

TABLE I
NEW MEADOW HAY, BROOKE, NORFOLK, 1929

<i>Average yield</i>	<i>Control</i>	<i>Low-Soluble</i>	<i>Medium-Soluble</i>	<i>High-Soluble</i>	<i>Standard Error</i>	<i>Standard Error per cent.</i>
cwt. per acre . .	10.9	12.6	13.6	13.7	0.45	3.52
Av., 1926-29 . .	22.6	25.5	27.9	31.0	0.86	3.21*

It will be noted that all forms of slag are still definitely better than the control plots in the fourth season, but though the slags still range themselves in the order of citric solubility the differences between the various types are smaller than in previous years. The figures for the whole four years of the experiment show a certain response to all types of slag, high-soluble slag being definitely better than both the others, and medium-soluble being very probably better than low-soluble. In any case the possible difference between medium and low-soluble slags is only of theoretical interest, for very little slag of medium solubility is on the market.

In this experiment the hay yields over the four seasons have amply repaid the cost of manures. Thus taking the high-soluble type as being the one in most general use, 100 lb. P_2O_5 in this form costs about 20s. after allowing for carriage, cartage and distribution. The return for this expenditure is 33.6 cwt. of hay, which is therefore obtained at a cost of 12s. per ton.

The fourth year of an exactly similar experiment was completed on the farm of Mr. E. Habberfield (Enmore, Somerset), with the assistance of Mr. Dallas, the soil being a red clay loam on sandstone. The figures for the final year, 1929, and for the average of the four years are given in Table II.

The action of slag is much smaller at this centre than at Brooke, but the response to phosphate has been shown to be real. Placing the weight of the produce against the cost of manure as before, the high-soluble slag gives 14 cwt. of hay at a cost of about 28s. per ton.

* These are the standard errors of the average results over four years, and show that nearly all the error is due to permanent characteristics of the plots.

TABLE II

OLD MEADOW HAY, ENMORE, SOMERSET, 1929

<i>Average yield</i>	<i>Control</i>	<i>Low-Soluble</i>	<i>Medium-Soluble</i>	<i>High-Soluble</i>	<i>Standard Error</i>	<i>Standard Error per cent.</i>
cwt. per acre . .	20.0	22.5	23.5	22.1	0.99	4.51
Av., 1926-29 . .	20.7	23.3	25.4	24.2	1.13	4.83

An examination of the full results of both trials shows a definite response to phosphate and, at Brooke, the superiority of the medium- or high-soluble product.*

Superphosphate on Potatoes.—Attention has been directed to the effect of increasing applications of superphosphate on the yield of potatoes by Mr. J. C. Wallace (Kirtton),² who came to the conclusion that on the silt soils of Lincolnshire the high dressings of superphosphate customary in that district could be reduced without detriment to the crop. These experiments were repeated on various soils in a series of 4 by 4 Latin Squares in 1928, and continued in 1929. The results are collected in Table III.

In 1928, the effect of superphosphate was considerable on the black fen soil and on the light sand at Woburn; in the first case 8 cwt. of superphosphate yielded 89 cwt. of potatoes at a cost of 4½d. per cwt., in the second 9 cwt. of superphosphate gave 49 cwt. at a cost of 9d. per cwt. At Wisbech the effect was small, but just significant, and at the other two centres the effect of phosphate was not significant. In 1929, a repetition of the experiments at Owmbly and Bangor confirmed their negative results; and in each case a higher degree of precision was reached than in the year before. At Wisbech there was a more marked increase for superphosphate, 2½ cwt. producing 16 cwt. of potatoes at a cost of 7½d. per cwt., and 10 cwt. producing 29 cwt. of potatoes at a cost of 1s. 5d. per cwt.

Enough has been done to show that the need for phosphate varies considerably with local conditions, and further work over a range of soils and seasons is desirable to follow out this question in detail. The series of results given in the table provide a good measure of the degree of accuracy to be expected from 4 by 4 Latin Squares conducted on potatoes.

* A new kind of low-soluble slag is now being manufactured which is different from the Fluorspar type used in the above experiments. The results discussed above only apply to the Fluorspar slags; the agricultural value of the newer type is now being ascertained.

TABLE III
EFFECT OF SUPERPHOSPHATE. ALL CENTRES, 1927-29
POTATOES: TONS PER ACRE

Year	Centre	Experimenter	Soil	No Super.	Single dose ¹	Double dose	Quad- ruple dose	Standard tons	error per cent.
1928	Stowbridge, Norfolk	J. H. L. Luddington	Black Fen ..	8.10	10.05	10.97	12.57	0.33	3.21
1928	Owmbly Cliff, Lincs.	E. Arden and J. A. McMillan	.. Oolitic limestone ..	8.18	6.79	7.73	7.25	0.27	3.66
1929	Owmbly Cliff	.. ..	.. ..	7.42	7.44	7.34	7.30	0.15	2.07
1928	Bangor ..	.. ..	.. ..	15.78	15.62	16.12	16.03	0.36	2.27
1929	Bangor ..	E. J. Roberts	.. Light gravelly loam..	14.66	14.25	14.53	14.66	0.18	1.22
1929	Midland Agric. Coll.	.. ..	.. ..	8.00	7.82	7.63	7.97	0.22	2.81
1928	Wisbech ..	H. G. Robinson	.. Light loam ..	16.98	17.32	17.55	17.75	0.27	1.54
1929	Wisbech ² ..	G. Major ..	.. Deep silt ..	11.67	12.48	12.82	13.11	0.15	1.17
1927	Woburn ³ ..	.. ..	.. Light sand ..	4.06	4.10	3.96	4.08	0.11	2.62
1928	Woburn ³ ..	.. ..	.. ..	12.25	13.43	14.00	14.69	0.27	2.00

¹ Single dose usually 2 cwt. superphosphate per acre.

² Single dose 2½ cwt.

³ Single, double and treble doses, unit 3 cwt. in this case.

The mean standard error of the ten experiments is 0.23 tons or 2.26 per cent. On the usual convention therefore a difference of 14 cwt. between mean yields can be detected. This may still appear to be a large difference, but it shows by contrast how slender must be the basis for demonstrating differences from experiments of the single plot type, which under the most favourable circumstances would have to be at least double this amount to be significant. Even with duplicate plots, as usually handled, the increase in precision is relatively slight.

A new type of experiment was undertaken in this series at the Wisbech centre, where it was desirable to ascertain whether different varieties of potatoes showed different degrees of response to phosphatic manuring. For this purpose each column of the 4 by 4 Latin Square was sown half with King Edward and the remaining half with British Queen seed, the actual order of the varieties within the column being at random. The arrangement is shown in Figure I.

A	B	B	A	B	A	A	B
3		1		2		4	
4		2		1		3	
2		4		3		1	
1		3		4		2	

Figure I

Key to treatments :—

- 1 No superphosphate.
- 2 2½ cwt. super. per acre.
- 3 5 cwt. " "
- 4 10 cwt. " "

Columns marked A and B were planted right through with British Queens and King Edwards respectively.

The average yields in tons per acre are given in Table IV.

		TABLE IV			
		No	2½ cwt.	5 cwt.	10 cwt.
		Super.	Super.	Super.	Super.
King Edward	..	12.60	13.28	13.69	13.88
British Queen	..	10.74	11.67	11.95	12.34

Statistical examination showed that there was a significant response to superphosphate on both varieties, but no differential response. King Edward was definitely superior to British Queen in yield. The most striking difference between the varieties in this experiment was the very much greater proportion of potatoes of ware size yielded by King Edward.

Experiments on Sugar Beet.—On Col. Wilson's farm near Colchester two 4 by 4 Latin Squares were laid down testing nitrogenous and potassic fertilizers respectively. The soil at this centre is a very light loam and sugar beet is extensively grown. In the nitrogen series, nitrate of soda and sulphate of

ammonia were compared in equal nitrogen in presence of a basal dressing of dung, phosphate and potash. The results are given in Table V.

TABLE V

	<i>Roots tons</i>	<i>Sugar per cent.</i>	<i>Tops tons</i>
No Nitrogen	7.02	18.03	5.16
2 cwt. Sulphate of Ammonia with seed	7.97	17.86	5.97
2½ cwt. Nitrate of Soda with seed	8.35	17.78	6.81
2½ cwt. Nitrate of Soda top dressed	8.28	17.81	7.18
Standard error	0.213	0.078	0.167
Standard error per cent. ..	2.69	—	2.66

All nitrogenous dressings gave significant increases in yield of roots and tops, but the only certain difference between forms of nitrogen was the greater effect of nitrate of soda on leaf production. There were indications that the nitrogenous fertilizers tended slightly to reduce the sugar content. The increases due to nitrogenous manuring were remunerative. Setting the value of roots and tops against the cost of manure and application, the sulphate of ammonia treatment leaves a balance of 32s. per acre and the nitrate treatments 50s. per acre in each case.

The potash experiment was designed to compare muriate of potash with low-grade potash salts and with agricultural salt equivalent in chloride to the potash salts, in the presence of a basal dressing of superphosphate and sulphate of ammonia. The yields are given in Table VI.

TABLE VI

	<i>Roots tons</i>	<i>Sugar per cent.</i>	<i>Root/Tops (from 4 plots)</i>
No Potash or Salt	5.92	17.64	83
2 cwt. Muriate of Potash ..	6.49	17.63	92
Equivalent 20 per cent. Potash Manure Salts	7.62	18.00	124
Agricultural Salt	6.87	17.84	87
Standard error	0.256	0.161	—
Standard error per cent. ..	3.80	—	—

Muriate of potash gave a small, and salt a larger increase in yield, while potash salts were significantly better than either potash or salt alone. The addition of salt gave a profit of 47s. per acre, muriate of potash 15s., while 20 per cent. potash salts left a gain of 73s.

A further experiment on sugar beet presenting certain points of interest was carried out by Mr. C. Harrison in the school garden at the County School, Welshpool. The system of replication was four randomized blocks of 4 plots each,

the plots being exceedingly small (1/160 acre). This trial showed that, given care, useful and significant results could be obtained in such a small scale trial. Three nitrogenous treatments were compared in presence of a basal dressing of dung, phosphate and potash. The yields are given in Table VII.

TABLE VII

	<i>Roots tons</i>	<i>Sugar per cent.</i>	<i>Tops tons</i>
No Nitrogen	11.6	17.90	16.5
3 cwt. Sulphate of Ammonia	13.5	17.21	21.1
Equivalent Muriate of Ammonia	12.8	17.66	20.3
Equivalent Cyanamide ..	13.8	18.06	19.2
Standard error	0.26	0.30	0.93
Standard error per cent. ..	1.98	—	4.81

All nitrogenous treatments gave significant increases in roots and in tops, but no certain effect on the sugar percentage. Muriate of ammonia was definitely inferior to the other forms in yield of roots.

Experiments on Barley.—Cereals have always presented a difficult problem to the field experimenter who is operating away from his base owing to the difficulty of securing the accurate thrashing of the produce of small areas. This has now been overcome by a sampling method worked out at Rothamsted by A. R. Clapham.³ A random sample is taken from each of the plots immediately before harvest, the constituent units being the produce of metre rows which are defined by the use of a suitably marked rod laid down along certain drills chosen at random. For greater accuracy the metre row is actually made up of two divided half metres marked along the rod and separated by a length which is neglected. The procedure is to cut off the corn standing between the marks on the rod, leaving a stubble of the ordinary length. The produce of the two half metre rows is combined by placing the ears in a paper bag, the mouth of which is secured round the straw with a tie-on label. The bagged produce of the metre rows is then put up in bundles by plots and taken to headquarters. It is allowed to dry off under cover and thrashed out in a specially constructed small machine,⁴ the sheaf weights and the corresponding dressed grain weights being taken.

If an estimate of the sampling error is required, and this is always desirable, the small sheaves from metre rows may be thrashed out separately or in several groups per plot. Otherwise a figure for yield may be obtained if the metre samples

are bulked for each plot and thrashed out all together. This reduces the work, but the magnitude of the sampling error is unknown; an estimate of the total experimental error may still, however, be obtained. Working in this way a trial with sulphate of ammonia, sulphate of potash and superphosphate in all combinations was conducted on barley on the farm of Mr. H. G. Neville at Wellingore, Lincs. The plot arrangement was two randomized blocks of 8 plots each. The soil is a light loam on the Lincoln Heath. The yields in cwt. per acre are given in Table VIII.

TABLE VIII		<i>Grain</i>	<i>Straw</i>
No Manure	O	18.8	16.3
1 cwt. Sulphate of Ammonia ..	N	19.5	17.9
3 cwt. Superphosphate ..	P	18.0	16.4
1½ cwt. Sulphate of Potash ..	K	20.7	18.1
Nitrogen and Potash	NK	20.6	19.7
Nitrogen and Phosphate ..	NP	22.4	20.7
Phosphate and Potash ..	PK	17.0	14.7
Nitrogen, Phosphate, Potash ..	NPK	25.1	24.1
Standard error		0.89	0.59
Standard error per cent. ..		4.38	3.20

The experiment was laid down chiefly to test the sampling method on an outside farm. Fortunately the effects due to manuring were large and a number of significant differences occurred. Using the usual symbols these may be expressed as follows:—Grain: NP better than O or P or N; NPK better than K or NK or PK. PK worse than K. Straw: as grain, and also NK better than N, NPK better than NP. Comparison of the single and combined effects of N and P provides a good case of the interaction between fertilizers. Singly each is ineffective, together a marked increase is obtained.

A 4 by 4 Latin Square was carried through on barley by Mr. J. M. Templeton at the Sparsholt Farm Institute, comparing the effect of muriate of potash with that of agricultural salt. The results, in cwt. per acre, are given in Table IX.

TABLE IX			
No Potash, no Salt .. .. .	..	..	23.9 cwt.
Muriate of Potash, 1 cwt. ..	..	..	23.5 cwt.
Salt, 100 lb. .. .. .	..	..	24.1 cwt.
Salt, 300 lb. .. .. .	..	..	24.4 cwt.
Standard error .. .. .	..	..	0.74 cwt.
Standard error per cent. ..	..	..	3.08 cwt.

In spite of a very accurate experiment no response to the manures was obtained in yield. When the percentage of nitrogen came to be examined it was found that this was rather higher where the chlorides had been given, and definitely so in the case of the heaviest dressing.

Labour and Personnel.—It is frequently urged against replicated experiments that an excessive amount of labour

and supervision is required. More labour must be expended per treatment on a replicated than on a single plot trial, but undoubtedly there is a much greater chance of obtaining useful results by the former method, particularly if small differences are looked for. It may be of interest to put on record (Table X) the labour expended in the replicated experiments on outside farms conducted by the Rothamsted Staff. These rates are intended as a rough guide only and will be corrected in the light of further experience. They are expressed in terms of sixteen plots, the least number likely to be put down in a replicated experiment. A supervisor will be occupied in all operations and will usually lend a hand with the work, so that he is included in the number of men.

TABLE X

Operation	No. of men	Average size of plots		Time for 16 plots hours	Remarks
		acres	plots		
Weighing and mixing manures	2	1/23	1½		
Laying out plots	2	1/35	1		
Applying manures by hand	2	1/36	1½		
Weighing hay (tripod) ..	3	1/10	8		2 ton crop.
Harvesting barley	2	1/60	9		Sampling method (320 metre rows) : good condition.
Picking and bagging potatoes	10	1/50	3½		8 pickers, 2 supervisors. Ploughed out.
Weighing potatoes on plots	4	1/50	¾		Heavy crop, 12 tons.

One of the most vital factors for success in this work is the willing co-operation of the farmer and his foreman, which can be secured by full discussion of the objects and details of the experiment and the utilization of all the intimate knowledge of land and cropping which their experience can provide.

The writers desire to record their indebtedness to Capt. E. H. Gregory for much valuable assistance in the carrying out of the experimental programme.

REFERENCES

¹ J. Wishart and H. J. G. Hines. "Fertilizer Trials on the Ordinary Farm." *Jour. Min. Agric.*, 1929, Vol. 36, No. 6, pp. 524-532.

² Kirtou Agricultural Institute: Report for 1927.

³ A. R. Clapham: "The Estimate of Yield in Cereal Plots by Sampling Methods." *Jour. Agric. Sci.*, Vol. XIX, 1929, pp. 214-235.

J. Wishart and A. R. Clapham: "Studies in Sampling Technique: The Influence of Manuring on the Yield of Potatoes." *Jour. Agric. Sci.*, Vol. XIX, 1929, pp. 600-618.

⁴ T. Wake Simpson: "Studies in Sampling Technique: Cereals II. A Small Scale Thresher and Winnower." *Jour. Agric. Sci.*, 1930 (in Press).

THE INFLUENCE OF THE FAT-CONTENT ON THE KEEPING QUALITY OF MILK

CAPTAIN H. BARKWORTH, M.C.,

South-Eastern Agricultural College, Wye.

IN all branches of the dairy industry there are those who hold that "rich milk does not keep so well." An attempt has been made to investigate this belief, approaching the matter from the comparatively simple standpoint of the butter-fat content as determined by the Gerber test. For this purpose samples were divided into three classes: below 3.00 per cent. butter-fat, 3.00-4.00 per cent. butter-fat (both inclusive), and those with a fat-content of over 4.00 per cent. The table gives a summary of the results.

Material was found in the results of clean milk competitions extending from 1923-1929. All samples are from mornings' milk received at the laboratory on the morning after production and tested for bacterial count when 27-28 hours old. No samples arriving later than that time are included, and only a few samples arrived at the laboratory on the same day that they were produced. Any such samples were kept overnight and tested at the same age as the others. Only a few samples gave arrival temperatures of over 60° F.

In order to put all samples on the same footing it has been necessary to tabulate them according to their nominal quarter-days:¹ and from this the average keeping quality has been calculated as true life,² on the assumption that all herds start milking at 6 a.m. giving an official "milking time" of 6.30 a.m. All herds are not, of course, milked at exactly the same time, but the variation is small in the case of the morning milking time, and an examination of data indicates that the times given represent very fairly the conditions in the area concerned. For the comparative purpose that we have in view, the differences caused by the use of a fixed milking time are not important, but the resultant average keeping qualities are, of course, not strictly comparable with figures obtained where the actual milking time has been recorded in each case.

In addition to samples from the South-Eastern Province, the table includes 1,262 samples, the results of which were supplied by Mr. L. J. Meanwell, of the National Institute for Research in Dairying.

Minor variations in the total number of colonies are not significant, and while there is a general relationship between the total count and the period of sweetness, variations in the

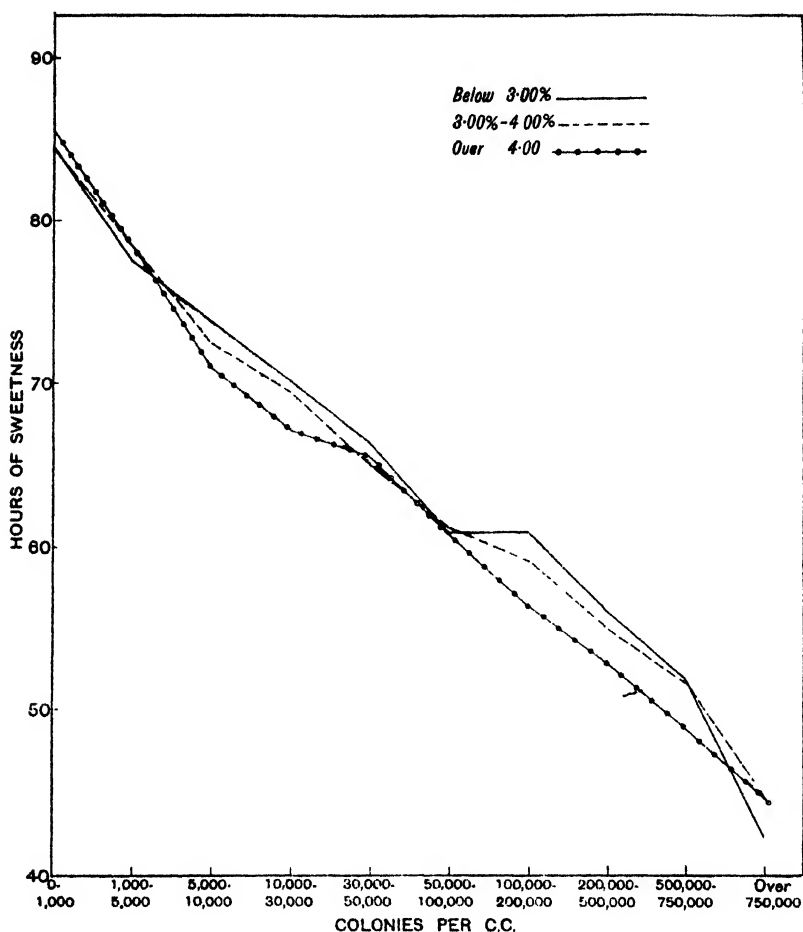
TABLE I.—EFFECT OF FAT CONTENT ON KEEPING QUALITY

Colonies per c.c.	Under 3.00% fat		3.00-4.00% fat		Over 4.00% fat	
	Total samples	Av. hr. of sweet- ness	Total samples	Av. hr. of sweet- ness	Total samples	Av. hr. of sweet- ness
0-1,000 ..	204	84.7	436	84.6	178	85.7
1,000-5,000 ..	191	77.6	421	78.4	153	78.4
5,000-10,000 ..	99	73.9	207	72.5	72	70.9
10,000-30,000 ..	124	70.2	286	69.4	115	67.1
30,000-50,000 ..	39	66.3	101	65.0	49	65.5
50,000-100,000 ..	40	60.85	129	61.2	57	60.7
100,000-200,000 ..	37	60.9	106	59.2	38	56.3
200,000-500,000 ..	42	56.0	125	54.9	44	52.8
500,000-750,000 ..	13	51.8	47	51.6	15	48.8
Over 750,000 ..	133	42.1	395	44.9	106	44.7
Totals ..	922		2,253		827	
	4,002					

period will occur owing to types of bacteria as opposed to numbers. Lastly, it will be obvious that the greater the total number of bacteria present the larger the increase required to make a significant difference. For these reasons it is usual to collect together the results of all samples of approximately the same count arranging thereby "count groups," which have a small range at the start and increase in range as the total count increases. In Table I, ten such count groups are made and the range in each case is given. In addition to recognizing total count and keeping quality the samples were further sub-divided according to their fat content. The net result of this treatment is shown in the table and also graphically.

Although the figures extend over a period of six years, the totals in some groups are still small, but it seems reasonable to assume that if a high butter-fat content in itself had any serious effect on the keeping quality of milk, this would be reflected in such a table.

In the particular figures before us, there is a suggestion that, while the keeping quality is not affected so long as the bacterial content is really low, there is a tendency for the samples of fat-content of over 4.00 per cent. to lose in average keeping quality as the count increases. The loss indicated is in the nature of 2-3 hours only, this period not amounting to a commercial factor.



In laboratory tests, milks are tested for sweetness at 9 a.m. and 5 p.m., and, in commercial practice, it is unlikely that a churn of milk would remain undisturbed for a longer period. The longer milk stands, the more compact the cream layer and the better the anaerobic condition in the milk underneath. This may be a factor, but no definite explanation of any loss through high butter-fat content is at the moment proven. In speaking of "rich" milk, the dairyman often implies points other than mere fat-content. The term may also cover ability to throw a deep cream layer, to give a clear demarcation between the cream-layer and the residue, and may even include colour. The fat-content has a bearing on the first two of these points, but temperature factors are also concerned. Breed is a factor in all three cases, though colour may be slightly influenced also by diet.

Whatever the causes, the figures before us indicate that if rich milks are considered in terms of butter-fat content they lose little if anything in keeping quality as compared with milks of lower fat content.

¹ Barkworth, H., "Numerical Interpretation of Keeping Quality," *San. Journ.*, No. 9, Vol. XXXIV, New Series, Apr., 1929, pp. 270-271.

² Min. of Agric.: *Guide to the Conduct of Clean Milk Competitions*. Misc. Pub. No. 43, Third Ed., 1928.

A SUCCESSFUL FARM IN EAST SUFFOLK

A. W. OLDERSHAW, B.Sc.,

Agricultural Organizer for East Suffolk.

THE following notes on the methods adopted by an East Anglian farmer, who has, up to the present, been successful in obtaining a small profit from his holding, may be of interest to other agriculturists in the very difficult conditions which now prevail.

The farmer in question, who is a farmer's son, was educated at a local secondary school and subsequently took a short course of training at an agricultural college. In 1918, he commenced operations as a tenant farmer some four miles from a market town, his holding comprising 170 acres, 30 being under grass and the rest arable. The soil is a good heavy loam containing plenty of lime, the geological formation being chalky Boulder Clay. Like the generality of upland grass in the dry Eastern Counties, the pasturage is not very productive, doubtless on account of the low rainfall. Despite treatment with basic slag, it carries little stock during a dry season. Indeed, so low is its productivity that it would probably be impossible to make a living from the holding if a large proportion of the land were under grass. One-year leys give far better crops of hay than the permanent meadows. The arable land is typical of the district, being well suited for the growth of wheat, barley, oats, beans, peas, lucerne, mangolds and sugar beet.

Livestock.—Great importance is attached by this farmer to the maintenance of a large head of live stock. Usually, he keeps seven working horses and three young horses, all pure-bred Suffolks, and he aims at having from one to three foals annually. Each year, one of the young horses, at the age of two years, is broken in. The cattle usually include 12 to 15 bullocks, which are fattened during the winter, two cows,



Peas growing in a wet season. The foreground is a wet patch and shows the failure of the crop which occurs in a wet season.



Ploughing in winter beans

A SUCCESSFUL FARM IN EAST SUFFOLK.

To face page 806.

which are kept to supply the household with milk, and one calf. The pigs number 200, including 20 Large Black sows which are crossed with a Large White boar. All the piglings are fattened.

There is a mill on the holding, in which all the corn, both home-grown and purchased, is ground for the stock. From an economic point of view, this arrangement has proved more satisfactory than purchasing meal. An oil engine supplies the power for the mill, although the farmer considers that it could be driven more economically by a tractor. The principal foodstuffs used are maize, barley and middlings as carbohydrate foods; peas, lentils and beans for protein; and fish meal as a source of animal protein and of minerals. No compound foodstuffs are purchased. A usual fattening ration for pigs consists of 65 per cent. maize or barley, 15 per cent. middlings, 15 per cent. leguminous corn (peas, beans or lentils), and 5 per cent. fish meal. On account of the low prices ruling last year, nearly all the corn produced, other than wheat, was used on the farm. In buying foodstuffs, manures, seeds and other supplies, a point is made of securing the discounts allowed by most firms for cash payments; it is realized that, spread over a year, these total up to a considerable percentage of the expenditure on these essentials.

More than 1,000 head of laying hens are kept, chiefly Rhode Island Reds and Leghorns. The poultry department has recently been increased. A considerable number of day-old chicks are sold during the season, and incubators having a capacity of 2,500 eggs are employed for hatching. Eggs for sittings are sold in considerable quantity. Eggs are also graded and sold to London customers, any surplus being disposed of at a local market. There are 2 colony poultry houses with free range, while others are small huts on wheels for use with wire pens. They are moved on to the stubbles in the autumn. Houses with slatted floors are being adopted, each house to hold 60 to 80 hens. Some of the houses are home-made, and the others were made locally by a village carpenter. One man is employed almost the whole of his time with the poultry, a boy helps and the farmer also gives his assistance and supervision. The poultry food consists chiefly of bran, middlings, maize meal, fish meal, whole wheat and cracked maize.

Recently, a small flock of grass-sheep has been purchased, the idea being that they would pick up a good deal that went to waste.

Arable Land.—The land, as previously stated, is mainly heavy, but it can all be ploughed with two horses on a single-furrow plough. A tractor is kept, and this is let out on hire when not required on the holding. Practically all the stubbles are broken up immediately after harvest in dry autumns, such as those of 1928 and 1929. In 1929, the tractor was kept going during harvest as soon as stubbles were available, one man being taken off harvest work and paid harvest wages to do the work. The tractor was not used on the binder as horses were available and it was considered more valuable for work elsewhere.

By means of autumn cultivation, combined with occasional pin or bastard fallows, it is found possible to keep the land clean without bare summer fallows. Bastard fallows are made after such crops as trefoil, or one-year grass mixtures, or after a rather thin plant of red clover which has been cut once and is not considered good enough to leave for seed. No fixed rotation is followed. Usually, about 30 acres each of wheat and barley are grown, with 10 to 12 acres of sugar-beet and 4 acres of mangolds. Beans, peas and various clovers are also grown, the clovers being frequently saved for seed. The land is somewhat heavy for sugar-beet, although good crops can be grown, but in a wet autumn it is rather difficult to get them off.

Manuring.—Farmyard manure is usually applied for beans and mangolds, and for other crops in the rotation when convenient. Artificial fertilizers are used for any crop likely to need help. As the land is heavy, the addition of potash as an artificial fertilizer for most crops is not considered necessary. Superphosphate is generally used as a source of phosphate, and nitrate of soda to supply nitrogen. The soda in the latter fertilizer is regarded as liberating potash. The only compound manure in use is a proprietary mixture obtained from a local farmers' co-operative society for little more than the cost of the ingredients purchased separately. As a rule, cereals are given 2 to 3 cwt. of superphosphate and 1 cwt. of nitrate of soda per acre; leguminous crops often receive 3 cwt. of superphosphate per acre; and roots are given farmyard manure, superphosphate and nitrate of soda. Sugar-beet appears to do better if farmyard manure is applied to the previous crop.

Labour.—The labour employed is supplied by eight men and a boy. No family labour is utilized, apart from assistance and supervision in all departments by the farmer himself.

It is noteworthy that, on a medium-sized farm of this character, the farmer is in touch with all details, and that, except in prolonged periods of bad weather, he can generally keep all his men at remunerative work. For example, when the weather is too wet or frosty for land work, farmyard manure may be carted, being heaped if the land is wet, or spread during frost. Buildings, gates and posts, machines and appliances can be overhauled, and such minor improvements as putting in pumps and drains can be undertaken without the assistance of skilled tradesmen.

Generally.—The small average profit derived from this holding, over a period of 12 years, is probably the result of a combination of factors, of which careful and economical management is, no doubt, the most important. The land has been kept clean and heavily manured, and, in consequence, good crops have been obtained. The land is well managed, and of a type from which good crops can be expected except, perhaps, in particularly wet seasons. When grain prices have been low, most of the home production has been consumed by the large head of live stock kept, and when prices improved, the grain has been put on the market. Both pigs and poultry have paid fairly well and have taken up much of the home-grown grain, saving the necessity of marketing it. The bullocks, too, have probably left a small profit, as they have provided a market for roots, straw, etc., produced on the farm. Sugar-beet has been useful during the past few years, and, from time to time, small profits have been made from clover seed production.

* * * * *

LICENSING OF STALLIONS UNDER THE HORSE BREEDING ACT, 1918

THE number of applications for licences for the year ended October 31, 1930, was 1,472, or exactly the same as in the previous year, but the number of licences issued decreased by 6 to 1,430.

<i>Number of Stallions Licensed in England and Wales</i>							
<i>Service Season</i>	1924	1925	1926	1927	1928	1929	1930
Shires	1,195	953	829	772	720	760	752
Other heavy horses	424	350	324	328	313	329	335
Light horses (including ponies)	591	546	455	437	381	347	343
	<hr/> 2,210	<hr/> 1,849	<hr/> 1,608	<hr/> 1,537	<hr/> 1,414	<hr/> 1,436	<hr/> 1,430

Licences were issued in respect of 1,087 heavy stallions, a decrease of 2 on the year, but more Suffolks and Percherons

were licensed, the decrease occurring in Shires and Clydesdales. Suffolks numbered 139, an increase of 10, and Percherons 42, an increase of 1, while Shires declined by 8 to 752 and Clydesdales by 5 to 128. There were, however, this year, more licensed stallions of each of the four heavy breeds than in the year 1928.

As regards light stallions, the increase in the number of Thoroughbreds which occurred in each of the previous three years was continued, this year's figure of 184 being 18 more than in 1929 and 46 more than in 1926. Most of the other breeds of light horses showed decreases, Hackneys again declining sharply and numbering only 32 against 45 in 1929, while Welsh Cobs decreased by 5 to 32.

The Horse Breeding Act has now been in force since 1920, and a comparison of the numbers of stallions of different breeds licensed in 1930 with those of that year is of interest.

NUMBER OF STALLIONS LICENSED IN ENGLAND AND WALES IN 1920 AND 1930.

BREED OR TYPE					NUMBER LICENSED		PERCENTAGE
					1920	1930	REDUCTION
							Per cent.
HEAVY—							
Shire	..	..	..	..	2,430	752	69·1
Clydesdale	..	..	..	..	296	128	56·8
Suffolk	..	..	..	..	197	139	29·4
Percheron	..	..	..	..	42	42	—
Other Heavy Horses	..	..	..	..	54	26	51·9
TOTAL HEAVY HORSES					3,019	1,087	64·0
LIGHT—							
Thoroughbred	..	..	..	..	185	184	0·5
Hackney	..	..	..	..	243	32	86·8
Welsh Cob	..	..	..	..	89	32	64·0
Other Light Horses and Ponies	..	..	..	..	213	95	55·4
TOTAL OF LIGHT HORSES AND PONIES					730	343	53·0
GRAND TOTAL					3,749	1,430	61·9

The total number of licensed stallions has declined in the 10 years by 62 per cent., the decrease being relatively sharper in heavy than in light stallions. Among heavy stallions the greatest percentage reduction is in Shires, while the number of Percherons has been maintained. Thoroughbreds show practically no change in the 10 years, but the decrease in Hackneys is exceptionally heavy, being nearly 87 per cent.

Licences were refused by the Ministry in respect of 42 applications for the 1930 season, an increase of 6 as compared with the previous season, but appeals against refusals were

lodged in only 5 cases against 12 in 1929. Of the 5 appeals 3 were successful. The breeds of the stallions rejected and the reasons for their rejection are given in the next table.

NUMBER OF APPLICATIONS FOR LICENCES NOT GRANTED AND GROUNDS OF REFUSAL, 1930.

BREED	Number Refused	Percentage Refused	DISEASE							
			Cataract	Roaring	Whistling	Ringbone	Sidebone	Shivering	Stringhalt	Defective Genital Organs
PEDIGREE--		%								
Shire	24	3.3	3	6†	6	2	5†	2	—	—
Suffolk .. .	6	4.2	1	—	1§	1	2†	—	1	—
Clydesdale ..	1	0.8	—	—	—	—	1	—	—	—
Percheron ..	2	4.5	—	—	1	1	—	—	—	—
Hackney .. .	1	3.6	—	—	—	—	—	—	1	—
Thoroughbred	3*	1.6	—	—	—	—	—	—	1	1
NON-PEDIGREE--										
Heavy .. .	4	4.8	—	—	—	2	1	—	1	—
Pony and Cob	1	10.0	1	—	—	—	—	—	—	—
TOTALS .. .	42	2.9	5	6	8	6	9	2	4	1

* A licence was also refused in respect of a Thoroughbred stallion that had been "tubed" and could not, therefore, be examined for its wind.

† 1 also affected with Shivering.

‡ 1 also affected with Ringbone.

§ Also affected with Shivering.

The number of infringements of the Act reported during the season was the same as in the previous year, viz., 14. Three unlicensed stallions were found travelling for service, and two unlicensed stallions were reported as being exhibited on premises not in the occupation of the owners with a view to use for service. In four of these cases proceedings were taken by the police and convictions were obtained in three cases, while the fourth was dismissed under the First Offenders Act. Nine stallions, though licensed, were found to be travelling for service unaccompanied by the licences.

Stallion owners in possession of licences for the year ended October 31, 1930, are reminded that these licences expired on that date, and should have been returned to the Ministry. Applications for licences for the service season November 1, 1930, to October 31, 1931, should be made as early as possible

on forms which may be obtained from the Secretary, Ministry of Agriculture and Fisheries, 10, Whitehall Place, London, S.W. 1.

NUMBER OF APPLICATIONS FOR LICENCES AND NUMBER OF LICENCES GRANTED AND REFUSED IN ENGLAND AND WALES, 1930.

BREED OR TYPE	PEDIGREE (i.e., Stallions entered or accepted for entry in the recognized Stud Book of their Breed)			NON-PEDIGREE (i.e., Stallions not entered or accepted for entry in a recognized Stud Book)			TOTALS OF EACH BREED AND TYPE (Pedigree and non-Pedigree)		
	Applications	Licensed	Refused	Applications	Licensed	Refused	Applications	Licensed	Refused
HEAVY—									
Shire ..	730	706	24	48	46	2	778	752	26
Clydesdale ..	123	122	1	6	6	—	129	128	1
Suffolk ..	143	137	6	3	2	1	146	139	7
Percheron ..	44	42	2	—	—	—	44	42	2
Others ..	—	—	—	27	26	1	27	26	1
LIGHT—									
Hackney ..	28	27	1	5	5	—	33	32	1
Thoroughbred ..	186	183	3	1	1	—	187	184	3
Arab ..	11	11	—	2	2	—	13	13	—
Cleveland Bay ..	3	3	—	—	—	—	3	3	—
Welsh Roadster ..	1	1	—	3	3	—	4	4	—
Hunter ..	2	2	—	1	1	—	3	3	—
Yorkshire Coach ..	2	2	—	—	—	—	2	2	—
Others ..	—	—	—	5	5	—	5	5	—
PONY AND COB—									
Welsh ..	14	14	—	—	—	—	14	14	—
Fell ..	14	14	—	—	—	—	14	14	—
Dales ..	12	12	—	2	2	—	14	14	—
Polo and Riding ..	11	11	—	1	—	1	12	11	1
Shetland ..	7	7	—	—	—	—	7	7	—
Highland ..	2	2	—	—	—	—	2	2	—
Welsh cob ..	28	28	—	4	4	—	32	32	—
Others ..	—	—	—	3	3	—	3	3	—
TOTALS ..	1,361	1,324	37	111	106	5	1,472	1,430	42

MARKETING NOTES

National Mark Eggs.—During the past few weeks, the seasonal decline in egg production has had the effect of reducing the quantities of National Mark eggs on the market, with a resultant hardening of prices. In most districts, the demand for National Mark consignments, which has now become a permanent feature of the trade, has far exceeded the supply. It is evident that quality, in conjunction with publicity, is reacting favourably on prices; National Mark “Standards” now show a price margin of as much as from 6s. to 7s. per 120 over the best imported eggs of comparable weight. This is the climax of a period beginning early last spring, in which, except for a brief interval late in August, National Mark eggs have steadily improved their relative position on the market.

It is important to remember that National Mark prices have also helped to lift the price level of ungraded eggs, so much so that, while producers have benefited, it has been difficult for authorized packers to obtain supplies that can be packed and sold under the Mark and at the same time give them a reasonable return for the services they are required to perform.

The progress of authorized packing stations during the past season is a matter of interest. It was not unexpected that some of the stations which, for various reasons—*e.g.*, severe local competition for supplies or lack of enterprise or of efficient management, etc.—have suffered financial loss on their working, should have withdrawn from the scheme. Others have been awaiting some statutory measure requiring the sale of eggs on the basis of weight or of statutory grade. Nevertheless, there are a number of stations that show a very encouraging increase in output; reference may be made to one of the producers’ co-operative stations that was formed for the purpose of working the National Mark Scheme, and has this year (*i.e.*, up to September 30) practically doubled its output, packing approximately 95 per cent. of it under National Mark labels. Such a development at one centre illustrates the potentialities in the National Mark Scheme when efficiently and energetically applied.

A further pointer to the growing importance of the Scheme is to be found in the fact that three competition classes for National Mark eggs were this year, for the first time, instituted in connexion with the Dairy Show held at the Royal Agricultural Hall, London, from October 21 to 24. It is hoped to publish a report upon these competition classes in the next issue of this JOURNAL.

National Mark Beef.—The number of sides (including quarters and pieces in terms of sides) of beef graded and marked with the National Mark for the five weeks ended October 25 was as follows :—

<i>Week ended</i>		<i>Select</i>	<i>Prime</i>	<i>Good</i>	<i>Total</i>
LONDON					
September	27 ..	682	1,023	20	1,725
October	4 ..	749	1,149	20	1,918
„	11 ..	706	1,009	42	1,757
„	18 ..	759	1,006	30	1,795

BIRKENHEAD*					
September	27 ..	114	542	1	657
October	4 ..	202	387	7	596
„	11 ..	141	540	6	687
„	18 ..	211	479	4	694

SCOTLAND*					
September	27 ..	1,741	598	—	2,339
October	4 ..	1,872	760	—	2,632
„	11 ..	1,580	742	—	2,322
„	18 ..	1,320	688	—	2,008

TOTAL LONDON SUPPLIES (<i>All Sources</i>)					
September	27 ..	2,537	2,163	21	4,721
October	4 ..	2,823	2,296	27	5,146
„	11 ..	3,427	2,291	48	4,766
„	18 ..	2,290	2,173	34	4,497

BIRMINGHAM					
September	27 ..	22	147	15	184
October	4 ..	34	198	19	251
„	11 ..	69	289	13	371
„	18 ..	51	265	42	358

* Sides consigned to London.

There was a steady demand for National Mark beef from London retailers during September.

During September, also, one or two more truck-loads of cattle were sent direct from farms to the Islington Abattoir, for sale on the basis of dead-weight and National Mark grades. The proportions of live weight to dead weight of these grass-fed cattle are of some interest. One truck-load of eight Welsh Blacks weighed 681·7 stones (14 lb.) live weight, and 704·2 stones (8 lb.) dead weight, thus showing an average “gain” of about 3 stones; a second consignment weighed 638 stones live and 663·5 stones dead. It has to be remembered that the cattle are weighed alive at Islington after a journey, when they are bound to weigh less than they would have weighed on the

farm. An average "gain" of 3 stones must, however, be regarded as satisfactory for this class of cattle. The majority of them were graded "Prime." It is hoped that more farmers will take advantage of this system of sale. Dead-weight quotations for cattle under the direct consignment scheme can always be arranged by the Ministry for intending consignors.

In Birmingham, as the figures show, the National Mark beef scheme has been steadily recovering from the local difficulties created by the wholesale meat salesmen at the end of May. A largely increased number of meat shops are now regularly selling National Mark beef.

Report of the Inter-Departmental Committee on the National Mark Beef Scheme.—A report of great interest to farmers has been presented by the Inter-Departmental Committee which was appointed in April last by the Minister of Agriculture and Fisheries and the Secretary of State for Scotland to review the progress made by the English and Scottish scheme for grading and marking beef.

In the Committee's opinion, the expense that has already been incurred on the scheme has been more than justified. In London, where the scheme has had a fair trial, the Committee shows that it was accompanied by a marked increase in the supplies of high-quality Scotch beef bought at Smithfield Market. Whereas in the months of December to May, 1928-29, the tonnage of Scotch beef at Smithfield was 7,250 (approximately valued at £650,000), in December to May, 1929-30, the corresponding tonnage was 8,758 (valued at £812,000). In the case of home-killed (English and Irish) beef, there was no actual increase in the quantities, but the value of the supplies rose by £55,000. An analysis of the grading of the London area reveals the fact that the scheme has caused a notable increase in the general level of quality. Thus, in October, 1929, there were 533 "Select," 3,754 "Prime" and 1,878 "Good" sides graded at Smithfield. The proportions of the various grades had changed to a marked extent by the spring of 1930. The figures for May were 2,248 "Select," 4,506 "Prime" and 315 "Good." Other tables in the report indicate the steadying influence of the National Mark scheme on wholesale prices, and the improvement in the price of English "Select" during the period of the scheme's operation. These figures are distinctly encouraging.

The Committee accordingly recommends that the existing schemes should be continued on the present experimental basis in London (including supplies from north-east Scotland and from Birkenhead) and in Birmingham up till October 31,

1931, and should be extended on the same basis for twelve months to the Leeds area and an area in South Wales, and to Edinburgh and Glasgow. The Manchester area should be considered for extension when a start has been made in the new areas. Further expansion depends, in the Committee's view, largely on the development of centralized slaughtering in the large towns.

Both the National Farmers' Union of England and Wales and the National Farmers' Union of Scotland gave evidence in support of the scheme, and stated that the beef-producing farmers were anxious that the scheme should be pushed forward.

No change is suggested in the existing grades—"Select," "Prime" and "Good"—although the Committee recognizes that when the scheme is extended to the Manchester area some modification as regards finish may be necessary to meet variations in demand. The advantages of the scheme in bringing the farmer into closer touch with the demands of the market are stressed.

The Committee approves the methods of publicity adopted by the Departments concerned, but considers that the volume of publicity has been inadequate and that, with the extension of the scheme, more preliminary and sustained advertisement should be given to it. In this connexion, the Committee remarks that, apart from State-aided publicity, home beef-producers, if they will organize comprehensively for the purpose, have been given, in the grading and marking scheme, a new and great opportunity to advertise their goods effectively.

Where, as in Birmingham, the support of the scheme by distributors cannot be relied on, the Committee considers that it would be feasible to make grading and marking compulsory in the consuming area concerned, and that as part of a compulsory scheme provision should be made for the payment by traders for the grading service.

The cost of grading has varied considerably since the start of the scheme in different areas. This was inevitable in view of the varying conditions met with. It is estimated, however, that in a provincial centre when the scheme is in full operation, the cost should not exceed 6d. to 8d. per side of beef. When the scheme has proved its value to producers and distributors, the whole or a substantial proportion of the expense should, in the Committee's view, be borne by the product.

Various other matters bearing on the National Mark scheme are discussed in the report. In particular, the Committee regards

as of considerable importance the experiments in fat-cattle marketing, on a carcass-grade and dead-weight basis, which have been carried on in London in connexion with the scheme, with the object of testing the advantages of sending stock direct from the farm to the abattoir and reducing intermediate charges. The suggestion is made that the Ministry, in conjunction with producers and distributors, should at a later stage consider the question of combining a scheme of insurance with this extension of the grading and marking service and charging an inclusive fee. The Committee points out that the greatest contribution which the farming community can make towards the success of the scheme is the improvement of the general average quality of British cattle, in particular by the elimination of the scrub bull.

Some representatives of the trade suggested that imported beef should be marked to indicate the country of origin. On this point, the Committee observes that such a measure, while militating against the sale of imported beef as English (and responsible representatives in the trade admitted that this was unfortunately a common practice), would make the National Mark beef scheme even more necessary than it is at present as a means of distinguishing between the superior and the inferior qualities of the home product.

The report,* which is unanimous and published as a Command Paper, is signed by the three members of the Committee, Lord Henry Cavendish Bentinck, Mr. George Dallas, M.P., and Sir Archibald Sinclair, Bart, M.P.

National Mark Apples and Pears.—Applications for enrolment under the National Mark apple and pear scheme continue to be received and are indicative of the good progress that is being made. The demand for National Mark fruit exceeds the supply, and the high prices now being realized for it in the wholesale markets contrast sharply with the quotations for ungraded and imported fruits.

National Mark Tomatoes and Cucumbers.—As a result of the quality guarantee afforded by the National Mark, coupled with the publicity which has been conducted by the Ministry, National Mark tomatoes and cucumbers have been in very large demand during the past season; in some cases, the demand has exceeded the supply, even at the peak of the season—in July. In spite of heavy importations, National Mark prices have been consistently good.

* Cmd. 3648/1930, to be obtained, price 9d. net, from His Majesty's Stationery Office, Adastral House, Kingsway, London, W.C.2, or through any bookseller.

National Mark Canned Fruit, Peas and Beans.—The demand for National Mark canned fruit, peas and beans continues to be very strong. Many of the leading authorized canners are carrying out big advertising campaigns, in which preference is given to National Mark goods. Extensive sampling of the output of authorized canners has shown that a high standard of excellence has been maintained, while reports from the Fruit and Vegetable Research Station, Campden, where the samples are examined, have revealed close conformity with the points of quality defined in the statutory grade definitions for the various products.

A recent issue of *Grocery* contained a comment on the increasing popularity of English canned fruits—attributing this mainly to improvements in grading and general quality—as a result of which there has been less demand for Californian supplies.

National Mark Wheat Flour.—The results of the bread-baking competitions in connexion with the Bakers' and Confectioners' Exhibition, held at the Agricultural Hall in September, amply demonstrated the fact that National Mark all-English (Yeoman) flour will make bread that compares favourably with bread made from ordinary baker's flour. The competitions included two classes for bread made from National Mark wheat flour, one being for commercial milk loaves, for which three prizes were given by the Ministry. This class attracted 29 entries, which was about the average number of entries for all the milk-loaf classes. The other class was for plain commercial bread made from National Mark flour, the prizes being given by the National Farmers' Union and the Ministry. There were 89 entries in this class, this number being exceeded only by the Championship class in private competitions. Some excellent loaves were shown in both classes, and the judges commented very favourably on the high standard of quality attained by the entries as a whole.

Further reports have been received regarding the increased demand for National Mark flour in some localities. A prominent firm of grocers in Manchester with a large trade in flour reports that National Mark flour now comprises $13\frac{1}{2}$ per cent. of its total turnover of flour. The firm sells mainly all-English (Plain); most customers use this flour for the home baking of bread, and it is noteworthy that up to the present they have been thoroughly satisfied with the results obtained. An authorized miller has sufficient confidence in the scheme to have placed an

order with his printer for 250,000 bags, specially designed for the trade in National Mark flour. This miller was among the first to apply for authorization in the scheme, and his experience during the first year's working has induced him to instal expensive new plant for packing National Mark flour in small bags.

National Mark Cider.—The Minister has made Regulations, entitled the "Agricultural Produce (Grading and Marking) (Cider) Regulations, 1930," prescribing grade designations and grade designation marks for cider.

The Regulations,* which prescribe two grade designations indicating the quality of cider made from apples and pears grown in England and Wales, will come into operation on November 10.

Publicity for National Mark Produce.—National Mark Weeks have been held at Southampton (October 4 to 11) and Llanelly (October 7 to 16), concurrently with the Southampton Industries and Trades Fair and the South Wales Grocery and Allied Trades Exhibition, respectively, at both of which an exhibition of National Mark products was staged by the Ministry. The tinplate industry of South Wales is closely interested in the continued expansion of the home fruit-canning industry, and National Mark canned fruit and canned peas and beans figured prominently in the Llanelly National Mark Week. Advertising in connexion with this Week covered a number of other towns in the district, including Swansea, where members of the local Grocers' Association made special displays of National Mark produce.

Wherever possible, shop window display competitions, for which the Ministry offers prizes, are organized in connexion with National Mark Weeks. Such a competition was held at Bradford during the Special Week in that town, September 24 to October 4—reference to which was made in the October issue of this JOURNAL—and a photograph of one of the winning displays is here reproduced.

The advertisements of National Mark beef, National Mark canned fruit, National Mark canned peas and National Mark malt extract with cod-liver oil, which are being shown on London omnibuses for several weeks, are attracting much attention. Photographs of two of these advertisements are reproduced here. Since this advertising campaign in London

* Copies of the Regulations may be obtained from H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2., price 1d. net, postage extra.

commenced, considerable quantities of National Mark shop display material have been asked for by, and supplied to, large London stores and shops, particularly in connexion with special displays of home and other Empire goods arranged to coincide with the Imperial Conference.

Arrangements have been made with the Empire Marketing Board for special lectures on the National Mark to be included in the Board's list of lectures available to Women's Institutes and kindred organizations, by means of which it is hoped to foster the interest of women of the countryside in the National Mark scheme.

Displays of Home Produce.—In addition to the National Mark exhibits staged at the Southampton Industries and Trades Fair and the South Wales Grocery Exhibition at Llanelly during the National Mark Weeks referred to above, a display of home produce was staged in the Empire Marketing Board section at the Imperial Fruit Show, Leicester, October 24 to November 1.

Marketing Demonstrations.—Demonstrations in improved methods of marketing agricultural produce were given during October at :—

London Dairy Show, October 21 to 24 (Bacon and
Agricultural Hall. Cheese).

Imperial Fruit Show, October 24 to November 1 (Fruit).
Leicester.

Preston Cheese Fair. October 28 (Cheese).

Demonstrations will be given during November as follows :—

Stoke-on-Trent Fat- November 26 to 27 (Pigs and
Stock Show. Bacon).

Birmingham Fat- November 29 to December 4
Stock Show. (Beef).

Nantwich Cheese Fair November 6 (Cheese).

Chester Cheese Fair November 12 (Cheese).

Whitchurch Cheese November 18 and 19 (Cheese).
Fair.

The Popularity of National Mark Produce.—The following is an extract from the notes of the Secretary of the Retail Fruiterers' & Florists' Association, Ltd., published in the *Fruit, Flower and Vegetable Trades' Journal* of September 20, 1930 :—

Although I have always been convinced that when the National Mark scheme has been more firmly established it would find favour in the eyes of the public, I must express astonishment at the hold it already has amongst consumers in many districts.

In the course of a number of interviews with retailers I have



One of the winning displays in the window dressing competition, held in connexion with the National Mark Week at Bradford (Sept. 24-Oct. 4).

PUBLICITY FOR NATIONAL MARK PRODUCE.



Publicity for National Mark Produce: advertising on London omnibuses.

gathered that in the more residential districts, chiefly the newly-developed estates, considerable interest has been shown in the scheme. Many retailers reported that they had experienced a consistent demand for National Mark cucumbers and tomatoes, and apples and pears in season, whilst strawberries had also been keenly sought, but great difficulty had been found in obtaining sufficient supplies on the markets.

Although of recent birth, the National Mark canned fruit scheme seems to have gained considerable ground. Indeed, in one particular shop where considerable stocks of a certain brand were held, part of which bore National Mark labels, and part devoid of the emblem, the trader asserted that the public regarded the cans without labels with suspicion, and showed a marked preference for those cans with the National Mark attached.

Recipe for Bread made from National Mark Flour.*—The following instructions for baking home-made, all-English bread have been supplied by the Director of the National Bakery School, London :—

PLAIN LOAF

3½ lb. of "*ALL-ENGLISH YEOMAN*" Flour.
1 oz. Salt. 1 oz. Yeast (*Distillers' compressed*).
1 oz. Lard.
1½ pints of water about 104° Fahr.

Take two basins and in each place 1 gill of the water at 104° Fahr. In one, dissolve the salt, and in the other break down the yeast. Now place the flour, into which the lard has been rubbed, in a bowl of suitable size and hollow it out in the centre. Into this hollow place 1 pint of the water together with the liquor from the basins. Mix together the flour and water by lifting them until all the flour is wetted. Then knead the mass until a clear piece of dough is obtained. In the case of some flours, it may be necessary, at this stage, to add anything up to an extra half gill of water at the same temperature, in order to incorporate all the dry flour in the dough. This however, is generally unnecessary.

The finished dough should be of a nice, medium consistency, and the temperature of it should be 82° Fahr. The dough should now be covered with a cloth and set in a warm place free from draughts. If the fireside is used, special care will be needed to prevent draughts.

At the end of 1 hour, place the dough on the table and knock it together thoroughly. Replace it in the basin and leave it for 1½ hours, at the end of which time it should be scaled off at 2 lb. 4 oz. for a 2-lb. loaf, or 1 lb. 3 oz. for a 1-lb size. After the loaf has been rounded and shaped, place in a greased tin and leave it to rise in a warm place for 45 minutes. At the end of this time, bake in a hot oven, for from 45 to 60 minutes, according to the temperature. The best results will be obtained with an oven temperature of 460° Fahr.

MILK LOAF

In making a milk Loaf, the above recipe should be followed, except that fresh milk should be used instead of water.

N.B.—It is sometimes the custom to add sugar, but this is not necessary. In milk bread, ½ oz. could be used.

* Copies of a leaflet (Marketing Leaflet 12d) containing this recipe may be obtained, post free, on application to the Ministry,

Marketing of Cheese in England and Wales.—The dairy industry is one of the most important sections of home agriculture, and in these days, when the production of milk greatly exceeds the needs of the liquid-milk market, a prosperous cheese industry is of vital importance to all dairy farmers, whether they themselves produce cheese or not. In view, therefore, of the important part played by efficient marketing in successful agricultural production, the latest addition to the Ministry's Economic Series of Reports (the Orange Books)* will be welcomed by all concerned. This Report is based on a comprehensive investigation of the methods of marketing cheese in this and other countries, which has been carried out by the Ministry with the aid of funds provided by the Empire Marketing Board.

The Report draws attention to the fact that 75 per cent. of the cheese supplies of this country are imported. It also indicates that, of home-produced supplies, about 75 per cent. is made on farms. In view of these facts, one of the most important conclusions arrived at is that British farm-made cheese, though in many cases greatly superior in quality to the imported product (largely factory-made), lacks, on the whole, the uniformity which is characteristic of much of the cheese supplied by our overseas competitors; while the position that the factory industry at present occupies as virtually subsidiary to the liquid-milk distributive trade makes it difficult for English factories to turn out consistently a product of quality even equal to that of imported Cheddar.

The Report emphasizes the importance of the cheese-grading schemes in operation in a number of exporting countries—several being described in detail—in securing the degree of standardization which, together with cheapness, is largely responsible for the capture of the market in the main consuming centres by the imported product. With the object of enabling the buyer to obtain supplies of home-produced cheese of reliable quality and, it is hoped, stimulating a higher level of production, the application of the National Mark to both farm and factory-made cheese is suggested, and a proposed solution of the none-too-easy technical problem of applying the Mark is put forward. The essential features of the proposed scheme are the application by producers of a mark guaranteeing fat-content and identifying the maker,

* *Report on the Marketing of Dairy Produce in England and Wales, Part I—Cheese.* Ministry of Agriculture and Fisheries, Economic Series No. 22. Published by H.M. Stationery Office. Price 6d. net. (Post free, 9d.)

and the subsequent application, just previous to the sale of the cheese to the retailer, of the National Mark to cheese that already bears the "producer's guarantee mark" and attains to a required standard of excellence in respect of quality as a whole. The performance of the operation in two stages is made necessary by the change in quality to which cheese is subject during the period of storage.

As the Report points out, the operation of such a standardization scheme would render almost inevitable the organization of the large numbers of cheese-makers in this country, on a variety basis, for the purpose of controlling the issue and application of cheese marks, on lines similar to those followed in the Netherlands system of cheese quality control. The germs of such an organization exist in the two English cheese-makers' federations—The Cheshire Cheese Federation and the English Cheddar Cheesemakers' Federation. Such control-organizations might eventually carry out additional functions, such as publicity, for the particular variety with which they may be concerned. Examples indicating what is being accomplished by cheese-makers' organizations abroad are quoted in the Report.

The future of the cheese industry in this country is difficult to forecast. The Report draws attention to the fact that farm-made cheese to a large extent supplies a specialist market, the demand of the masses of the population for a low-priced article being more easily met by factory cheese, which lends itself to mass production and "routine marketing." The Report foresees that, if the increase in milk production continues, there is the possibility of the extension of single-purpose factory cheese-making of the type which had commenced to develop in this country in the latter half of last century in response to the influx of imported factory cheese, but the growth of which was checked by the expansion of the fluid milk market. The advantages of the single-purpose factory lie not only in the higher quality of the product, but also in the more efficient utilization of the by-product—whey. It is certain, however, that the organization of the cheese industry in the future will not be solely determined by the needs of the industry itself. As the Report concludes, "the bearing of the cheese industry on the dairy industry as a whole—its function as a balancer of supply and demand in the fluid milk market—connects it with still wider problems which again depend for solution on the creation of some comprehensive organization of milk producers generally."

NOVEMBER ON THE FARM

WILLIAM LAWSON, M.B.E., N.D.A., N.D.D.,

Director of Agriculture for West Sussex.

In the Fields.—*Sowing of wheat*, especially on the colder types of soils, if not already done, should be completed as early as possible ; such soils give few opportunities later in the season or early enough in spring to ensure satisfactory results. Soils of a lighter character and at a low elevation can be sown with wheat much later and still give a fair chance of success. In the southern counties a good deal of wheat is sown after the removal of mangolds or sugar-beet, and a good practice is to plough and furrow-press the land, sow the wheat and cover in with the harrows all on the same day. The large farm with multiple teams has a considerable advantage over the small one-team farm for work of this nature. Little Joss wheat has a good reputation for late sowing, and owing to the lateness of the season the quantity of seed should be more liberal.

The lifting of mangolds should be completed as early as possible, and the labour released from this work can be diverted to other seasonable work.

Hedges.—The maintenance of the hedges can now be attended to. Live fences have many advantages and do much to beautify the landscape. They are, however, expensive to maintain, and if allowed to get out of order become useless as a fence and not infrequently become a harbour for vermin. Hedges require attention at least once a year ; neglect means deterioration and increased expenditure at a later period if the fence is to remain useful. On reasonably well-cultivated arable land the hedges do get annual attention, but on pasture land it is too frequent to find accumulations of neglect, and thorns and brambles spreading from the fence and encroaching on the fields.

Ditches.—No less important is the maintenance of ditches. Drainage is the foundation of all successful cultivation both on arable and grass land. A survey of any agricultural district will indicate the immense amount of thought, skill and labour which has been expended in days gone by in laying out fields, planting hedges and cutting ditches. It is seldom that these can be much improved upon from the point of view of efficiency, though in many cases the fields are too small for economic large-scale cultivation. Neglect to maintain ditches in an efficient state leads to gradual deterioration of the land, a condition that is not rapidly rectified when the condition of the ditch is restored to an efficient state. Another feature

of neglected ditches that take the water from pipe drains is the silting over of the outlets. In few cases are the drains properly charted, and it is a real grievance with many a farmer who is taking over a new farm that there is nothing to indicate where the outlets are, or even whether the land is pipe-drained or not. It is not uncommon for farmers to continue making fresh discoveries in this direction many years after their occupation of a farm commenced. Very few ditches have been made unnecessarily, and there is every reason for keeping them in order and now is a good time to do the work.

With the Stock.—This month is the beginning of a severe and trying period for live stock of all kinds. The days are short and the weather cold and windy. The remnant of the autumn grass may tempt farmers to rely too much on what is now rather indifferent food for other than purely maintenance purposes. Where cattle are wintered out the situation should be of a sheltered character and the ground reasonably dry. A fair range is better than a too-confined space, but where small fields only are available the stock should be frequently changed round. Supplementary feeding may vary from a supply of hay or straw to a fairly complete ration with roots and cakes or meals. The amount and kind of food will vary very much with the class of cattle and the circumstances, but the method of giving the supplementary food can make a difference to its usefulness. A very practical and shrewd farmer who makes a success of his business, but does not write notes, considers that his success in outwintering cattle is due to giving the supplementary food regularly at the same time each day, and that time always early in the day, so that the cattle will not waste time waiting for the arrival of the food; and when it was finished they had time to range, and select for themselves a suitable sheltered spot to spend the night. Grass sheep with adequate scope have less need for supplementary food than cattle; indeed, the hardy mountain breeds on the poorest of fare seldom get supplementary food except during a heavy or protracted snowstorm. The same sheep under lowland conditions and in more or less confined situations will require supplementary food according to the extent of the limitation of their grazing. Now that grass sheep are increasing on the lowland areas, in many cases in the hands of men who are not used to them, it should be noted that grass sheep require some attention and that in shepherding grass sheep there is an art no less important than with folded sheep. There is some difference

of opinion as to whether the grazing should be in fields and the sheep changed round frequently or over the entire available range at one time. The former is preferred by many, but a good number are very successful with the latter method. Where the one-range method is adopted care should be taken that the whole range is more or less used.

The dairy cow now comes under full winter conditions. Feeding and management are more completely under control in winter than during summer. The main variable factor is the quality of the bulky foods such as hay and straw. Most farmers recognize the value of good fodder, but the actual extent of the damage that can be done by inferior material is not always appreciated. The amount of good hay that can be used is considerable, but where inferior hay is used it should be limited in amount and a more bulky concentrated ration given. The general management of the dairy cow is no less important than its food.

In very many cases, especially where the milk has to be delivered twice a day, the intervals between the milkings are very uneven. The nearer in equality the intervals are, the better the results, whether the total number of milkings is two or three per day. Not infrequently the intervals may be something like 9 hours between the morning and afternoon milkings and 15 hours between the afternoon and morning. In such circumstances, the morning's milk is larger in quantity but poorer in quality than the afternoon milk, but the quantity is not proportionately greater having regard to the number of hours since the previous milking. Milking at intervals of twelve hours would be an ideal, and was at one time a regular feature, especially on cheese-making farms. Ideals are not always economic possibilities, but it would be of interest to know exactly how close to uniform the intervals could be made economic at present cost of labour. "Three times milking" requires more labour, and the advantage over two milkings where the intervals are uneven is considerable, but except for really heavy-milking cows it is doubtful how far it would be justified over twice milking at even intervals. Uneven milking intervals have another disadvantage in that the bulk of the feeding is given also in the shorter interval, although the first and last feed respectively may be given before the morning milking and after the evening milking. Cows are fortunately somewhat adaptable in their feeding requirements as regards the number of times they are fed. Super cows which require large amounts of concentrated food to meet their daily require-

ments would need to have it distributed over a greater length of time than is necessary for the average cow. Whatever the number of times of feeding or milking may be it is most important to feed with strict regularity and to adhere generally to the use of concentrates followed by roots and subsequently by bulky fodder. Under such a system the cow would ration herself in bulky fodder and if the quantity given is readily cleared up within twenty minutes of feeding there should be no need to worry.

It should not be necessary to stress the importance of water in relation to the general health of the cow. Mangolds are a source of water, and where no roots are fed the need for water at more frequent intervals is imperative. A constant supply of water for the cow when tied up is a commendable ideal, but the milk yields obtainable under this arrangement, as compared with that of access to water twice daily, show less increase than might be expected.

* * * * *

NOTES ON MANURES

H. V. GARNER, M.A., B.Sc.,
Rothamsted Experimental Station.

Choice of Phosphates.—In considering the improvement of poor grass land or the maintenance of herbage already in good condition phosphate will in most cases be the main requirement, and the question of the choice of suitable phosphatic fertilizers is sure to arise. It must be admitted at the outset that a complete answer to this question for all cases is not at present available, for the range of soil and climatic conditions to be explored is very wide, while modifications are being made in the nature of phosphatic fertilizers and new forms are from time to time being introduced.

The points of difference between phosphatic manures fall under the following heads :—

- (1) Availability or rapidity of action, in which superphosphate and basic slags of high citric solubility usually take the lead.
- (2) Provision of lime in quantities which, although small when judged by the ordinary standards of liming, are none the less appreciable. Basic slags are the best-known in this respect, and on an equal phosphate basis the low-grade slags furnish more lime than the high grade.
- (3) Unit cost, in which the finely-ground mineral phosphates work out at the most favourable rates.

For general purposes basic slag maintains its place in the esteem of grassland farmers. The greater part of the home-produced article is of the same degree of solubility as the pre-war Bessemer slag which was used in the early experiments at Cockle Park and elsewhere, although appreciably lower in phosphate content (9-16 instead of 18 per cent. phosphoric acid). When dressings are adjusted to compensate for the change in grade, the same results may be expected from English high-soluble slags as from high-grade Bessemer slag, of which a relatively small amount is still imported from the Continent. Basic slags made with fluorspar, and showing a lower degree of citric solubility than the above, have been tested against the other types at many centres and have on the whole been slower to act, although in most cases a pronounced benefit has followed their use. More recently a type of low-soluble slag has been introduced to which the above findings may not necessarily apply, and this is at present being compared with high-soluble open-hearth slag at a number of centres in a new series of experiments. Farmers in the neighbourhood of works producing low-soluble slag can obtain this material at cheaper unit rates than are asked for the high-soluble type. We may say, therefore, that for most typical grassland soils and districts basic slag will be a safe choice as a phosphatic manure, and that, where it is important to secure an effect in the first season, a type which carries the guarantee of approximately 80 per cent. solubility in citric acid is to be preferred.

Superphosphate has in the past been somewhat overshadowed by basic slag as a source of phosphate for grassland improvement, and where the latter is known to act rapidly and well there is no reason to employ the somewhat more expensive water-soluble phosphate. Nevertheless, in dry situations and on calcareous soils superphosphate is quite in place, and its value is well-known to farmers in such regions. Further, it has the advantage in speed of action, and if application has been delayed until early spring it has been observed to affect the following hay crop rather more certainly than basic slags. With a highly soluble manure like superphosphate there is something to be said for the practice of giving little and often rather than a large initial application to last for a period of years.

Evidence is still accumulating with regard to the conditions which favour the use of ground rock phosphate and its performance in comparison with other sources of phosphoric acid. The opinion is that on the whole the effect of ground rock

phosphate is slower to appear than that of high-soluble basic slags. This is particularly so on the drier soils and in districts of low rainfall. Many observers report that the action begins to be marked in the year following application rather than in the first season. Moist conditions, a pronounced need for phosphate, a long, growing season, and a fine degree of grinding all seem to be helpful to its action. Very fine grindings of North African phosphate are now available. A common grade is the same as that of basic slag, *i.e.*, 80 per cent. through the 100-mesh sieve, while 85 per cent. through the standard sieve is readily obtainable. A further grinding furnishes a material at least 90 per cent. of which passes the 100-mesh sieve, while in some cases 90 per cent. is guaranteed to pass a sieve having 120 meshes per linear inch.

Bone phosphate has a considerable popularity for pasture improvement among farmers in certain districts, as, for example, in Cheshire and Shropshire. At present steamed bone-flour, which is the most suitable form for rapid utilization, is rather cheaper than usual and approaches superphosphate and high-grade slags in unit price. A mixture of superphosphate and steamed bone-flour is a popular dressing for pastures on calcareous soils.

In applying any form of phosphatic fertilizer, and in particular the less soluble forms, to grass land, the condition of the surface is important. The manure must find access to the soil before any benefit can be secured. Hence, growth should be grazed down, coarse patches mowed back, and any surface mat opened up by heavy harrowing. This surface preparation is in itself beneficial as it favours the development of the finer herbage, and this is further stimulated by the manure applied.

Grazing Experiment.—One of the striking results of the Cockle Park experiments in which the effects of manures on pasture are measured by the live-weight increase of the grazing stock is the much better utilization of the herbage by cattle and sheep together than by grazing with sheep alone. The live-weight gains over a period of years were approximately twice as great under the first system as under the second. Most of the grazing experiments so far reported have been carried out with sheep alone. A report of the mixed grazing trial,* carried out at Shoby by the Leicestershire Agricultural Education Committee, as part of the Research scheme of the Royal Agricultural Society, is therefore of considerable interest.

* T. Hacking, *Jour. Roy. Agric. Soc.*, Vol. 90, 1929.

The soil is Boulder Clay at 400 ft. elevation, and was taken over in poor and badly-grazed condition. Five plots, each of about 10 acres, were put down in 1923, and, after a preliminary year devoted to a uniformity trial, various phosphatic manures were applied and mixed grazing was continued for six seasons. Basic slag (30 per cent. phosphate) applied at 13 cwt. per acre was the most successful treatment, and there appeared to be a slight advantage in giving this amount in two dressings of $6\frac{1}{2}$ cwt. three years apart rather than in applying the whole as a large initial dressing. Finely-ground North African phosphate applied at one dressing of $6\frac{1}{2}$ cwt. per acre was less effective than basic slag in these experiments, while the feeding of cotton cake on plots receiving half the standard dressing of slag gave no cash gain above that produced by the full dressing of slag alone. It was observed that systematic grazing and surface cultivation considerably improved the herbage quite apart from manuring, as shown by the appearance of the unmanured plots.

Fertilizers and Bushel Weight.—Some interesting points in connexion with the effect of manurial treatment on the quality of crops come out on examination of the bushel weight of grain in relation to manures applied. The general view is that potassic fertilizers help the movement of starch to the grain, and, since a well-filled grain is usually associated with a good bushel weight, the use of potash on soils deficient in this constituent might be expected to increase the bushel weight of the corn. Samples from a number of field experiments carried out in Germany have recently been examined from this standpoint and gave the following results when expressed in English units :—

<i>Crop</i>		<i>No. of expts.</i>	<i>Bushel Weight, lb.</i>	
			<i>Without Potash</i>	<i>With Potash</i>
Wheat	.. ..	5	57·4	60·3
Barley	.. ..	7	51·2	52·0
Oats	.. ..	26	35·9	39·8
Rye	.. ..	10	53·3	55·8

In every case the bushel weight was increased by the inclusion of potash in the manure, oats and wheat being affected most and barley least. It was noted in these experiments that in some cases where the yield was not increased by the addition of potash nevertheless the bushel weight of the grain was raised.

The classical fields at Rothamsted and Woburn afford data along the same lines. The bushel weight of barley seems to

be little influenced either by potassic or the other standard manures. Thus, comparing the bushel weight of the grain from 10 plots receiving no potash with a corresponding series getting potash on Hoosfield, Rothamsted, we have :—

			<i>Mean Bushel Weight, lb.</i>	
			<i>Without Potash</i>	<i>With Potash</i>
First 20 years of experiment	..	..	53.4	53.7
Last 20 years of experiment	..	..	52.4	52.6

The most marked effect was produced by potash when sulphate of ammonia was the source of nitrogen, the bushel weight being raised from 51.9 lb. to 52.9 lb. over the last 20-year period. At Woburn the only direct comparison is when sulphate of potash has been added to nitrate of soda, the corresponding bushel weights being 49.8 lb. and 50.5 lb. over the 20 years 1907-26.

Figures affording a direct comparison of the effect of sulphate of potash on wheat over a long period are as follows :—

			<i>Bushel Weight, lb.</i>	
			<i>Without Potash</i>	<i>With Potash</i>
Rothamsted (50 years), Sulphate of Ammonia				
+ Superphosphate	..	..	58.0	60.3
Woburn (20 years), Nitrate of Soda	..	..	57.9	58.8

The early experiments on oats at Rothamsted bring out only the effect of minerals as a whole and not potash individually. Over five seasons, two treatments showed a mean bushel weight of 34.8 lb. without minerals and 36 lb. with minerals. It is significant that where the biggest yield-increase for potash is obtained (approximately 11 bushels of wheat per acre) there also is the largest increase in bushel weight, 2.3 lb. per bushel. Where barley yields $4\frac{1}{2}$ bushels more grain per acre at Woburn following potash manuring the bushel weight is also appreciably increased. The effectiveness of fertilizers is commonly regarded from the standpoint of crop increase, and this is their most important action. Nevertheless, with the bigger crop, there are usually associated secondary effects such as the above, which although small in themselves are well worthy of notice.

PRICES OF ARTIFICIAL MANURES

Description	Average prices per ton during week ended October 8				
	Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) ..	9 7d	9 7d	9 7d	9 7d	12 1
Nitro-chalk (N. 15½%) ..	9 7d	9 7d	9 7d	9 7d	12 1
Sulphate of ammonia :—					
Neutral (N. 20·6%) ..	9 1d	9 1d	9 1d	9 1d	8 2
Calcium cyanamide (N. 20·6%) ..	8 7e	8 7e	8 7e	8 7e	8 1
Kainit (Pot. 14%) ..	3 6	2 19	2 17	3 0	4 3
Potash salts (Pot. 30%) ..	5 3	4 18	4 17	4 14	3 2
" (Pot. 20%) ..	3 15	3 9	3 6	3 5	3 5
Muriate of potash (Pot. 50%)	9 10	9 3	8 16	8 19	3 7
Sulphate,, (Pot. 48%)	11 11	11 6	10 17	10 16	4 6
Basic Slag (P.A. 15½%)|| ..	2 13c	2 3c	..	2 9c	3 1
" (P.A. 14%)|| ..	2 7c	1 16c	1 16c	2 3c	3 2
" (P.A. 11%)|| ..	..	1 9c	1 9c	..	..
Ground rock phosphate (P.A. 26-27½%)|| ..	2 2a	2 10a	2 5a	2 7a	1 9
Superphosphate (S.P.A. 16%)	3 11	..	3 9	3 6	4 2
" (S.P.A. 13½%)	3 5	2 18	3 3	3 0	4 4
Bone meal (N. 3½%, P.A. 20½%)	8 15	8 10	8 7	6 15	..
Steamed bone flour (N. ½%, P.A. 27½-29½%) ..	5 17b	5 15f	5 15	4 7	..

Abbreviations : N.—Nitrogen ; P.A.—Phosphoric Acid ; S.P.A.—Soluble Phosphoric Acid ; Pot.—Potash.

* Prices are for not less than 6-ton lots, for delivery during the month, at purchaser's nearest railway station, unless otherwise stated. Unit values are calculated on carriage paid price.

§ Prices are for not less than 2-ton lots, net cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. price.

|| Fineness 80% through standard sieve. a Prices for 6-ton lots f.o.r. at makers' works.

b Delivered (within a limited area) at purchaser's nearest railway station.

c Prices for 6-ton lots ; at Bristol, f.o.r. Bridgwater ; at Hull and Liverpool, f.o.r. neighbouring works, and at London f.o.r. depots in London district.

d For lots of 4 tons and under 6 tons the price is 1s. per ton extra and for lots of 2 tons and under 4 tons 6s. per ton extra.

e Delivered in 4-ton lots at purchaser's nearest railway station.

f Delivered Yorkshire stations.

NOTES ON FEEDING STUFFS

H. G. SANDERS, M.A., Ph.D.,
School of Agriculture, Cambridge.

Dry Cows.—During recent years much has been said about the feeding of dry cows ; it has been urged very strongly that high feeding right up to calving pays for itself time and again by the increased yields that are obtained in the following lactations. There is surprisingly little in the way of experimental evidence to support this, but most farmers who have tried it have considered it well worth while, so that it is probably true. It is not proposed here to go into the question of how much cake should be fed or of the best foods to use, but rather to try to indicate some of the physiological processes that are at work, and to show the logical basis for the newer methods of feeding dry cows, together with their limitations. Rule of thumb is all very well, but appreciation of the underlying factors gives intelligence a chance, and points the way to correct variations of procedure for individual cases.

Some cows go dry before they are intended to, and others keep on milking despite efforts to stop them, so that there is great variation in the length of time cows are dry previous to calving. Most farmers, if questioned on the subject, would express the opinion that it pays to give a cow a rest of 6 weeks or 2 months, and on the average that is just about what is allowed. The average length in the east of this country is just about 8 weeks, whilst in the north-west it is longer—about 11 weeks. Averages, however, though useful up to a point, only tell a part of the story ; though the average is 8 weeks in the eastern counties some cows are not dry at all, and others at the opposite extreme have a rest of something like 6 months. Nearly 20 per cent. of the cows have periods of rest of less than 3 weeks, and these would suffer in their next lactation to the extent of over 10 per cent, say 70 gallons of milk ; in the last 4 or 5 weeks of the previous lactation, when they ought to have been dry, they would give an average yield of at most 45 gallons, so that the loss must be round about 25 gallons each year : this loss occurs with every fifth cow in the eastern counties, and in the aggregate it must amount to a colossal volume of milk. A longer rest than 8 weeks is wasteful of time, and leads to progressively larger losses as it is increased ; nevertheless nearly one-third of the cows in the east of England (and many more in the west) are dry for more than 10 weeks,

indicating a further great loss of milk at this end of the scale.

These considerations show that there is plenty of room for improvement; the best length of rest is between 6 and 8 weeks, and this is realized by farmers, but, though the average is all right, less than 20 per cent. fall within this range. There are undoubtedly cases which might advisedly fall outside the 6 to 8 weeks' range, but in practice it is usually the wrong ones that do so, and consequently it should be more widely appreciated what the physiological processes are that occur when a cow is dry.

The most obvious occurrence during the dry period is that the cow puts on flesh. Her life is rather an uneven one as regards the balance between food intake and expenditure; for a certain period after calving, when her yield is at its highest, she is living beyond her income and loses weight. As the yield drops she comes to an even balance, and subsequently her food is more than sufficient for her yield, and storage of food materials in her body takes place. When the balance actually changes over is, of course, determined by the rate of yield and the appetite (assuming her to be fed correctly), and fluctuates widely from cow to cow. With many cows the appetite will allow very little over and above the needs for the milk at any time during the lactation, and consequently storage can only occur when the cow is dry. In all cases there are better chances for storage when the cow is not milking, and the reserves accumulated will be very useful to fall back upon at the flush of the next milking period. That storage itself, as distinct from the rest from milking activity, has a beneficial effect on the next lactation yield has been shown by American work, where the planes of nutrition of two lots of cows were kept at the opposite extremes, and high feeding before calving was found to raise the yield, irrespective of the length of time dry. In passing, it is striking to notice that this work (done some 20 years ago) is still the only truly experimental justification for the "steaming up" system.

It might be expected that storage of nutrients against the drain at the time of maximum flow in the next lactation would show itself by putting that maximum up, but this is not the case. The highest point reached by a cow is determined by other factors, and the actual size of the glands (*i.e.*, the udder less the fat and connective tissue it contains) is probably of great importance in this connexion; consequently food storage during the dry period is more helpful in the later stages of the next lactation, and makes the production more uniform over

that period by staving off the fall. At the beginning of a lactation a good dairy cow will produce milk under practically any conditions. In another American investigation a very "milky" cow was kept on a bare maintenance ration for a month at the flush of her lactation, and despite the great shortage of food her yield only fell by 1 lb. from the beginning to the end of the month, though on its completion she was so weak that she could not stand. It is improbable that a more beefy animal would give such a startling result, but it serves to show that food material is not necessarily a decisive limiting factor in early lactation; it is rather that, after the initial stimulus is weakening, it becomes important as a means of keeping up the production.

High feeding after calving can do rather more than stave off the fall, as it has been shown to lead the cow to higher levels than she would otherwise have reached, but storage before calving has comparatively little effect in this way. There remains any amount of scope for further inquiry into this subject of food storage during the dry period; we have only the haziest ideas as to the physiological processes involved, and of the chemical reactions that are carried out. We have no idea of what wastage there is in converting food materials first into body substance, and at a later date converting this into milk constituents; nor of the effect on the fat-percentage of the milk thus subsidized by body reserves; nor as to whether the raising of the condition of the cow affects her resistance to disease.

Storage is an important occurrence during the time the cow is dry, but it does not account for the whole of the benefits of a rest; there is still a part of the effect left over for which the explanation must be sought in the changes occurring in the gland as a result of the fact that the cow is pregnant. Whilst the cow is carrying a calf her udder is being prepared for the production of milk. In the first pregnancy of a heifer this can be easily seen, and, though not so noticeable, similar changes occur during later pregnancies. The actual cells of the gland are in some way reconditioned. Though we have some knowledge of the secretions which cause this we have practically none as to the exact procedure, but what apparently happens is that many (possibly all) of the cells are (as it were) closed for repairs. This building up for the next lactation is a process of the opposite nature to actual secretion, so that milk yield is affected while it is going on. The effect can be detected by studying the yield of pregnant cows; it is found that it starts

immediately after service, but has only a very slight influence in reducing the yield for the first half of pregnancy. At this point, however (20th week of pregnancy), there is a sudden change, and the yield falls away rapidly. As in all cases with cows there is great variation in behaviour from one individual to another, but these tendencies can be seen in all. It seems only reasonable to assign the extra bit of the effect of the dry period, not accounted for by storage, to this process ; it is probably hampered if the milk flow is kept going all the time, and a certain minimum period (and the indications are that this minimum period is about 6 weeks) of rest from milking, so that it can go forward unchecked, is necessary for its full completion.

Thus the effect of giving a cow a rest between milking periods is a double one : it allows her to store up food, and gives her gland a chance to become fully efficient. The former is a slow and continuing process, and from this point of view the longer the rest the better for the cow's next lactation yield. The latter can be accomplished in a relatively short time, but cannot be effectively completed without a rest, however high the plane of feeding is. We thus understand why it is that absence of rest between lactations leads to serious depression of yield, and that, though the longer the rest the greater the storage, comparatively little gain is made by lengthening it beyond 6 weeks, and that after about 8 weeks the extra milk in the next lactation will be insufficient to make up for that lost in the previous one by drying the cow off so soon. This is shown to be the case by the statistical analysis of milk records, which enables the magnitude of the effects to be measured. A cow dry for only a week will have her next lactation yield reduced by 14 per cent., as compared with what she would do if dry for 6 weeks. The reductions for 2, 3, 4, and 5 weeks are, respectively, 9, 6, 3, and 1 per cent., whilst the gains for longer rests than 6 weeks are smaller and run something under 1 per cent. for every week. It therefore follows that there is an optimum length from the economic point of view ; that this optimum is realized by farmers makes it all the more deplorable that such heavy losses are incurred by departure from it in the wrong cases. It is freely admitted that the true optimum is not quite the same for all cows, but a consideration of those cases where a deviation from it is desirable will have to be postponed.

DESCRIPTION	Price per qr.		Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.	Price per lb. starch equiv.	Pro- tein equiv.
	s. d.	lb.	£ s.	£ s.	£ s.		s. d.	d.	%
Wheat, British	—	—	7 2	0 11	6 11	72	1 10	0-98	9-6
Barley, British feeding	—	—	5 10	0 8	5 2	71	1 5	0-76	6-2
" Danubian	16 6	400	4 12	0 8	4 4	71	1 2	0-62	6-2
" Persian	16 0	"	4 10	0 8	4 2	71	1 2	0-62	6-2
" Russian	16 3	"	4 12	0 8	4 4	71	1 2	0-62	6-2
" Tunisian	19 6	"	5 10†	0 8	5 2	71	1 5	0-76	6-2
Oats, English, white	—	—	5 13	0 9	5 4	60	1 9	0-94	7-6
" " black and grey	—	—	5 13	0 9	5 4	60	1 9	0-94	7-6
" Canadian mixed feed	13 9	320	4 17*	0 9	4 8	60	1 6	0-80	7-6
" Argentine	13 9	"	4 17	0 9	4 8	60	1 6	0-80	7-6
" Chilian	15 0	"	5 5	0 9	4 16	60	1 7	0-85	7-6
" German	23 3	"	8 3	0 9	7 14	60	2 7	1-38	7-6
Maize, Argentine	24 6	480	5 15	0 9	5 6	81	1 4	0-71	6-8
" South African	25 6	"	5 18	0 9	5 9	81	1 4	0-71	6-8
Beans, English Winter	—	—	6 15§	1 2	5 13	66	1 9	0-94	20
Peas, Japanese	—	—	18 10†	0 19	17 11	69	5 1	2-72	18
Dari	—	—	8 5	0 10	7 15	74	2 1	1-12	7-2
Milling offals—									
Bran, British	—	—	4 2	0 19	3 3	42	1 6	0-80	10
" broad	—	—	5 10	0 19	4 11	42	2 2	1-16	10
Middlings, fine, imported	—	—	5 15	0 15	5 0	69	1 5	0-76	12
" coarse, British	—	—	5 2	0 15	4 7	58	1 6	0-80	11
Pollards, imported	—	—	4 15	0 19	3 16	60	1 3	0-67	11
Meal, barley	—	—	6 0	0 8	5 12	71	1 7	0-85	6-2
" maize	—	—	7 10	0 9	7 1	81	1 9	0-94	6-8
" " South African	—	—	5 17	0 9	5 8	81	1 4	0-71	6-8
" " germ	—	—	5 15	0 13	5 2	85	1 2	0-62	10
" locust bean	—	—	6 5	0 7	5 18	71	1 8	0-89	3-6
" bean	—	—	10 0	1 2	8 18	66	2 8	1-43	20
" fish	—	—	18 0	2 17	15 3	53	6 0	3-21	48*
Maize, cooked flaked	—	—	8 0	0 9	7 11	83	1 10	0-98	8-6
" gluten feed	—	—	6 15	0 17	5 18	76	1 7	0-85	19
Linseed cake, English, 12% oil	—	—	10 10	1 6	9 4	74	2 6	1-34	25
" " " 9%	—	—	9 15	1 6	8 9	74	2 3	1-20	25
" " " 8%	—	—	9 7	1 6	8 1	74	2 2	1-16	25
Soya bean cake, 5½% oil	—	—	8 2*	1 16	6 6	69	1 10	0-98	36
Cottonseed cake—									
" " English, 4½% oil	—	—	4 10	1 4	3 6	42	1 7	0-85	17
" " Egyptian, 4½%	—	—	3 17	1 4	2 13	42	1 3	0-67	17
Decorticated cottonseed meal, 7% oil	—	—	9 10*	1 16	7 14	74	2 1	1 12	35
Ground-nut cake, 6-7% oil	—	—	6 5§	1 4	5 1	57	1 9	0-94	27
Decorticated ground-nut cake, 6-7% oil	—	—	7 12	1 16	5 16	73	1 7	0-85	41
Palm kernel cake, 4½-5½%	—	—	6 0§	0 15	5 5	75	1 5	0-76	17
" " " meal, 4½%	—	—	6 10§	0 15	5 15	75	1 6	0-80	17
" " " meal 1-2% oil	—	—	5 10§	0 16	4 14	71	1 4	0-71	17
Feeding treacle	—	—	5 15	0 8	5 7	51	2 1	1-12	2-7
Brewers' grains, dried ale	—	—	4 7	0 16	3 11	48	1 6	0-80	13
" " " porter	—	—	4 0	0 16	3 4	48	1 4	0-71	13
Malt culms	—	—	6 0†	1 4	4 16	43	2 3	1-20	16
Dried sugar beet pulp	—	—	5 5	0 7	4 18	65	1 6	0-80	5-2

* At Bristol. † At Liverpool. § At Hull.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of September and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative values of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, if palm kernel cake is offered locally at £7 per ton, then since its manurial value is 15s. per ton as shown above, the food value per ton is £5 5s. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 1s. 8d. Dividing this again by 22-4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 0-89d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculation a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own markets. The figures given in the table under the heading manurial value per ton are calculated on the basis of the following unit prices:—N., 8s. 0d.; P₂O₅, 2s. 11d.; K₂O, 2s. 0d.

Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follow :—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (imported)	71	6.2	4 16
Maize	81	6.8	5 16
Decorticated ground nut cake	73	41.0	7 12
„ cotton cake	71	34.0	8 15

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 1.35 shillings, and per unit protein equivalent, 2.03 shillings. An explanation of the method of calculation employed is given in the Report of the Departmental Committee on Rationing of Dairy Cows.*

In accordance with the recommendation of this Committee, the “food values” given in the following table may be taken as applicable to the ensuing four months, December to March, inclusive, for the purposes of advisory schemes on the rationing of dairy cows.

FARM VALUES

CROPS	Starch equivalent Per cent.	Protein equivalent Per cent.	Food value per ton, on farm £ s.
Roots—			
Kohl Rabi	8	0.5	0 12
Mangolds	7	0.4	0 10
Potatoes	18	0.6	1 6
Swedes	7	0.7	0 11
Turnips	4	0.4	0 6
Green foods—			
Cabbage, drumhead	7	0.9	0 11
„ open-leaved	9	1.5	0 15
Kale, marrow stem	9	1.3	0 15
Silage, vetch and oats	13	1.6	1 1
Hay—			
Clover hay	38	7.0	3 6
Lucerne hay	29	7.9	2 15
Meadow hay, poor	22	2.9	1 16
„ „ good	37	4.6	2 19
„ „ very good	48	7.8	4 1
Seeds hay	29	4.9	2 9
Straws—			
Barley straw	23	0.7	1 12
Bean straw	23	1.7	1 14
Oat straw	20	0.9	1 9
Wheat straw	13	0.1	0 18
Grains and seeds—			
Barley	71	6.2	5 8
Beans	66	20.0	6 10
Oats	60	7.6	4 16
Peas	69	18.0	6 10
Wheat	72	9.6	5 17

* Obtainable from H.M. Stationery Office, Adastral House, Kingsway, W.C. 2, price 6d. net.

MISCELLANEOUS NOTES

A NOTE published in last month's issue of this JOURNAL (October, 1930, p. 646) gave some particulars of experiments conducted by the Department of Agriculture and Horticulture of the University of Bristol in the control of moles. That Department has issued a more detailed account of these experiments in a bulletin, "Mole Destruction Experiments," and readers interested may obtain copies gratis on application to the Agricultural Advisory Office, 22 Berkeley Square, Bristol.

* * * * *

PRICES of agricultural produce in September were on average 42 per cent. above those ruling in the base years 1911-13, as compared with 35 per cent. and 52 per cent., respectively, a month and a year earlier. The rise of 7 points from August was due primarily to increases in the prices of milk and potatoes.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1925 :—

Month				Percentage increase compared with the average of the corresponding month in 1911-13.					
				1925	1926	1927	1928	1929	1930
January	..	..	..	71	58	49	45	45	48
February	..	..	..	69	53	45	43	44	44
March	..	..	..	66	49	43	45	43	39
April ..	..	..	..	59	52	43	51	46	37
May ..	..	..	..	57	50	42	54	44	34
June ..	..	..	..	53	48	41	53	40	31
July ..	..	..	..	49	48	42	45	41	34
August	..	..	..	54	49	42	44	52	35
September	..	..	..	55	55	43	44	52	42
October	..	..	..	53	48	40	39	42	—
November	..	..	..	54	48	37	41	44	—
December	..	..	..	54	46	38	40	43	—

Grain.—Following the slight advance in wheat prices between July and August, a substantial reduction was recorded in the month under review, and the index number fell by 7 points to 3 per cent. below 1911-13, this being the first occasion since 1914 that the wheat index has been lower than the pre-war level. The marketing of new crop barley was accompanied by the customary advance in quotations, the September average being 1s. 11d. per cwt. higher on the month at 3 per cent. in excess of September of the base years.

Values for oats receded 2d. per cwt., but as the reduction was proportionately less than that recorded between August and September, 1911-13, the index number was one point higher at 12 per cent. below pre-war. As compared with a year ago, wheat was 2s. 7d. per cwt., and barley and oats 2s. per cwt. cheaper, the index figures being lower by 34, 24 and 29 points, respectively.

Live Stock.—Quotations for fat cattle were a little lower during the month under review, and the index number declined by 2 points to 35 per cent. above the 1911-13 level. Fat sheep were unchanged both in price and index number. In the case of fat pigs, the advance recorded in August was not maintained during September; quotations for second quality bacon pigs eased by about 9d. per score lb. and for porkers by about 4d., and the relative index figures were 8 and 6 points lower at 33 and 44 per cent. respectively above pre-war. Both dairy cows and store cattle were about 4s. per head cheaper on the month, and the index numbers declined by 4 and 3 points, respectively, to 31 and 27 per cent. in excess of 1911-13. Values for store sheep were rather higher at 69 per cent. above the base level. Store pigs, however, showed a decline and the index number was 5 points lower at 107 per cent. above pre-war.

Dairy and Poultry Produce.—Milk prices in most areas rose to winter levels during September, and the index figure was 42 points higher than in August at 100 per cent. above 1911-13. A year ago, the corresponding figure was 107 per cent. Butter, however, was slightly cheaper at 24 per cent. in excess of pre-war. Values for cheese moved upwards, but as the rise was proportionately less pronounced than that recorded in the base period, the index number declined by 6 points. Egg prices continued their seasonal advance, but the rise was rather below normal and the index number was 4 points lower at 36 per cent. in excess of 1911-13. At the corresponding period last year, eggs were 57 per cent. dearer than pre-war. The index for poultry during September fell by 3 points to 40 per cent. above the base level.

Other Commodities.—Quotations for potatoes were rather higher on the month at 51 per cent. above pre-war, a rise of 39 points as compared with September last year. Prices of clover hay fell by about 2s. 6d. per ton, while the meadow variety also was a trifle cheaper, and the combined index for both kinds of hay was 4 points lower at 11 per cent. above 1911-13. Fruit averaged 6 per cent. and vegetables 28 per cent.

more than in the base period. Values for wool were slightly reduced to 8 per cent. below pre-war.

Index numbers of different commodities during recent months and in September, 1928 and 1929, are shown below :—

Percentage increase as compared with the average prices ruling in the corresponding months of 1911-13.

Commodity	1928	1929	1930			
	Sept.	Sept.	June.	July.	Aug.	Sept.
Wheat	22	31	7	2	4	—3*
Barley	50	27	—4*	—12*	—12*	3
Oats.. .. .	33	17	—16*	—20*	—13*	—12*
Fat cattle	36	34	27	30	37	35
„ sheep	59	55	66	66	62	62
Bacon pigs	33	52	46	40	41	33
Pork „	32	55	52	49	50	44
Dairy cows.. .. .	34	35	29	32	35	31
Store cattle.. .. .	27	16	28	29	30	27
Store sheep.. .. .	66	63	65	78	66	69
Store pigs	28	83	101	100	112	107
Eggs	52	57	29	44	40	36
Poultry	42	45	57	47	43	40
Milk	65	107	55	58	58	100
Butter	54	52	24	31	33	24
Cheese	78	42	42	32	28	22
Potatoes	60	12	—40*	23	25	51
Hay	14	42	25	18	15	11
Wool	76	47	—1*	—4*	—5*	—8*

* Decrease.

* * * * *

Fifteenth International Agricultural Congress, 1931.—The Fifteenth International Agricultural Congress will be held at Prague from June 5 to 8, 1931, under the patronage of the President of the Czecho-Slovak Republic. Subjects for discussion include agricultural instruction, agricultural propaganda, agricultural co-operation, rural economy, rural industries, animal and plant production, and the place of women in agriculture. Application for stand space and other information should be made to the General Secretary, Comité d'Organisation du XVe Congrès International d'Agriculture, 2, Rue Dlázdená, Prague.

Farm Workers' Minimum Wages.—A meeting of the Agricultural Wages Board was held on Tuesday, September 23, 1930, at 7 Whitehall Place, London, S.W. 1, the Right Hon. The Viscount Ullswater, G.C.B., presiding.

The Board considered notifications from Agricultural Wages Committees of decisions fixing minimum and overtime rates of wages and proceeded to make the following Orders carrying these decisions into effect.

Gloucestershire.—An Order to continue the operation of the existing minimum and overtime rates of wages from October 5, 1930, until

October 3, 1931. The minimum rates in the case of male workers of 21 years of age and over are : Head-carters, 36s. per week of 52½ hours in the week in which Christmas Day falls and 60 hours in any other week in winter ; 34s. 6d. per week of 51 hours in the week in which Good Friday falls and 58 hours in any other week in summer. Under-carters, 34s. 6d. per week of 50½ hours in the week in which Christmas Day falls and 57 hours in any other week in winter ; 32s. 6d. per week of 48 hours in the week in which Good Friday falls and 54 hours in any other week in summer. Head-shepherds or head-stockmen, 36s. per week of 52½ hours in the weeks in which Christmas Day and Good Friday fall and 60 hours in any other week. Under-shepherds or under-stockmen, 34s. 6d. per week of 50½ hours in the weeks on which Christmas Day and Good Friday fall and 57 hours in any other week. Other male workers, 30s. per week of 39½ hours in the week in which Christmas Day falls, 48 hours in any other week in winter, 41 hours in the week in which Good Friday falls and 50 hours in any other week in summer. Overtime is payable in the case of all classes of male workers at 9d. per hour on weekdays and 11d. per hour on Sundays, Christmas Day and Good Friday. In the case of female workers the minimum rate is 5d. per hour for all time worked irrespective of age.

Lincolnshire (Holland).—An Order to come into operation on October 26, 1930 (*i.e.*, the day following that on which the existing rates are due to expire), and to continue in force until October 31, 1931, fixing minimum and overtime rates of wages for male workers and minimum rates of wages for female workers. The minimum rates in the case of male workers of 21 years of age and over are : 33s. 6d. (instead of 35s. as at present) per week of 50 hours in summer and 48 hours in winter, with in addition in the case of cattlemen and shepherds 6s. per week, and in the case of horsemen 10s. per week to cover employment other than overtime employment in excess of those hours. In the case of shepherds certain payments have also to be made in respect of the lambing season. The Order also provides for reductions in the minimum rates for male workers of 17 and under 21 years of age. The overtime rates for male workers of 21 years of age and over are 9d. per hour, except on Saturdays when the rate is 10½d. per hour, and on Sundays when the rate is 1s. 1½d. per hour. In the case of female workers of 15 years of age and over the minimum rate is 6d. per hour for all time worked.

Shropshire.—An Order cancelling the existing minimum and overtime rates of wages as from December 20, 1930, and fixing fresh rates as from December 21, 1930. The minimum rate in the case of male workers of 21 years of age and over is 32s. 6d. per week of 44½ hours in the weeks in which Christmas Day and Good Friday fall, and 54 hours in any other week, with overtime at 9d. per hour, except for employment on Sundays on work other than the care of and attention to livestock when the rate is 10d. per hour. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour with overtime at 6d. per hour.

Pembroke and Cardigan.—An Order continuing the operation of the existing minimum and overtime rates of wages from October 1, 1930, until September 30, 1931. The minimum rate in the case of male workers of 21 years of age and over is 31s. per week of 52 hours in winter and 54 hours in summer with overtime at 9d. per hour. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour for a day of 8 hours with overtime at

6d. per hour on weekdays, 6½d. per hour for the first three hours of overtime on Sundays and 7½d. per hour for subsequent hours.

Copies of the Orders in full may be obtained on application to the Secretary of the Agricultural Wages Board.

* * * * *

Enforcement of Minimum Rates of Wages.—During the month ending October 14, legal proceedings were instituted against 20 employers for failure to pay the minimum rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases are as follows:—

County	Court	Fines			Costs			Arrears of wages involved			No. of workers involved
		£	s.	d.	£	s.	d.	£	s.	d.	
Buckingham	Chopping Wycombe	1	0	0	0	16	0	21	18	9	4
Cumberland	Carlisle ..	1	0	0	2	7	0	10	7	0	1
Gloucester	Berkeley ..	4	0	0	2	0	0	26	11	3	3
„	Chipping Sodbury	—			0	10	6	5	1	10	1
Lancaster	Lytham ..	—			3	3	0	11	10	3	2
Salop	Bishop's Castle	*			0	9	6	22	17	6	1
„	Wellington ..	1	0	0	1	18	0	4	12	0	3
Yorks, N.R.	Scorton ..	*			2	11	0	45	15	4	3
„	W.R. Knaresborough	1	0	0	—			36	7	10	2
„	„ Rotherham	10	0	0	—			33	0	0	2
„	„	10	0	0	—			100	0	0	2
„	„	0	5	0	0	4	0	1	2	9	1
Anglesey	Llangefni ..	1	0	0	—			11	10	0	2
Cardigan	Cardigan ..	3	0	0	—			19	0	8	2
Carmarthen	Carmarthen	1	0	0	—			2	2	0	1
Denbigh	Llangollen ..	—			0	9	0	3	2	3	1
Glamorgan	Barry ..	4	0	0	—			15	11	0	2
„	Neath ..	5	0	0	4	4	0	5	0	0	1
„	Swansea ..	—			5	5	0	15	0	0	3
Montgomery	Machynlleth	*			0	16	0	16	16	0	2
		£42	5	0	£24	13	0	£407	6	5	39

* Dismissed under Probation of Offenders Act.

* * * * *

Foot-and-Mouth Disease.—A further outbreak was confirmed on September 28 at Bilsdale, Stokesley, Yorkshire (North Riding). The previous outbreak in that locality—referred to in the October issue of this JOURNAL—was confirmed on September 20. No further outbreaks having occurred in the Yorkshire (West Riding) or Surrey infected areas, or in the Yorkshire (North Riding) infected area since September 28, the restrictions in force in those areas were withdrawn on September 29 and October 14 and 19 respectively.

* * * * *

APPOINTMENTS

COUNTY AGRICULTURAL EDUCATION STAFFS : ENGLAND.

Cornwall : Mr. E. Beckley has been appointed Head Gardener and Lecturer at the Tamar Valley Experimental Station, *vice* Mr. C. E. Grainger.

Derbyshire : Mr. G. E. Limb, B.Sc., N.D.A., has been appointed District Agricultural Organizer, *vice* Mr. G. H. Bates, B.Sc.

Devonshire : Mr. J. E. F. Jenks, N.D.A., C.D.A., has been appointed District Lecturer in Agriculture, *vice* Mr. J. N. Sharrock, N.D.A., N.D.D.

Essex : Mr. R. J. Fleming, N.D.D., B.D.F.D., has been appointed Assistant Instructor in Dairying, *vice* Miss G. M. Woods, N.D.D., B.D.F.D.

Mr. R. N. Sadler, N.D.A., N.D.D., has been appointed District Agricultural Organizer and Lecturer in Dairy Husbandry.

Herefordshire : Mr. S. F. Siderfin has been appointed Manager of the County Egg-Laying Trials.

Isle of Ely : Mr. W. F. Choal, N.D.A., D.I.C., has been appointed Horticultural Superintendent, *vice* Mr. W. G. Kent, N.D.H.

Kent : Mr. W. Corbett has been appointed Instructor in Glass-house Work and Market Gardening.

Mr. L. C. Turnill has been appointed Assistant Instructor in Poultry Keeping.

Norfolk : Mr. P. E. Cross* has been appointed Assistant Instructor in Horticulture.

Miss E. Turnbull has been appointed Manageress of the County Egg-Laying Trials.

Shropshire : Mr. W. E. Usher, B.Sc., has been appointed Agricultural Instructor, *vice* Mr. T. B. Evans, B.Sc.

Mr. A. H. Whyte has been appointed Horticultural Lecturer, *vice* Mr. R. Duncan.

Miss B. A. M. Chamberlin has been appointed Assistant Instructress in Poultry Keeping.

Miss B. Halford has been appointed Manageress of the County Egg-Laying Trials.

Sussex (West) : Miss K. Elliott, N.D.P., has been appointed Manageress of the County Egg-Laying Trials.

Wiltshire : Mr. W. Saint has been appointed Manager of the County Egg-Laying Trials, *vice* Mr. F. R. Wallbutton.

Yorkshire (Agricultural Department, University of Leeds) : Miss E. M. Crossley, N.D.D., has been appointed Assistant Instructress in Dairying, *vice* Miss M. L. Evelyn, N.D.D.

Mr. J. M. Mackay, B.Sc., A.I.C.E., has been appointed Assistant Lecturer in Agricultural Engineering, *vice* Mr. H. Preston, B.Sc., A.M.I.Struct.E.

Miss W. E. Jolly has been appointed Instructress in Rural Domestic Economy.

WALES.

Carmarthenshire : Miss P. M. Jones has been appointed Instructress in Rural Domestic Economy.

Glamorganshire : Mr. C. R. S. Gregory has been appointed Instructor in Horticulture.

PRINCIPAL WHOLE-TIME MEMBERS OF TEACHING STAFFS AT UNIVERSITY DEPARTMENTS OF AGRICULTURE, AGRICULTURAL COLLEGES, ETC., IN ENGLAND AND WALES.

Studley College, Warwickshire.

Miss Bryan, B.Sc., has been appointed Lecturer in Botany and Chemistry, *vice* Miss M. Madge, B.Sc., Ph.D., resigned.

Miss M. Pringle, N.D.D., C.D.P., has been appointed Assistant-Instructress in Poultry Husbandry, *vice* Miss V. Dowse, N.D.A., resigned.

Miss K. F. Kaye, N.D.D., C.D.A., has been appointed Lecturer and Instructress in Agriculture.

* Wholly employed by the County Council, but only partially on agricultural education work.

THE JOURNAL OF THE MINISTRY OF AGRICULTURE

Vol. XXXVII. No. 9.

DECEMBER, 1930.

NOTES FOR THE MONTH

ONE of the most valuable qualities the farmer can possess to-day is adaptability ; and, in general, he has it in a very real though perhaps not readily recognized form. Farming is a slow business, and does not lend itself to sudden changes.

Grazing Problems

There is the character of the soil as a limiting factor ; the farming tradition of the district built up on centuries of experience ; and the adopted rotation of crops which fit in with one another and produce the most economic return for the expenditure. There may be many other factors which operate against change, but notwithstanding them all, the careful observer to-day will find modifications of farming practice going on gradually in almost every part of the country ; and he will find that although the steps taken to reach something better are necessarily slow, sound reason is usually on the side of the practising farmer.

To take an example : temporary leys are recommended for the East Anglian farmer as a means of conserving labour and adding to the fertility of his soil. After due thought, he responds by laying land down to lucerne, thus securing even greater soil enrichment and a higher degree of insurance against drought. The farmer is advised to adopt intensive rotational grazing ; but he is not normally short of grass in summer (i.e., up to the limit of his capital in these times) and he knows that in a drought, water, not fertilizer, is the determining factor. He does not, therefore, too readily adopt the new system, but he quickly takes in that part of the lesson which gives him a lengthening of the grazing season at both ends by the aid of artificial manures, and he remembers for use another part of the story which shows the excellent effect of nitrogen on Italian rye-grass in promoting early spring keep. The great thing, he is well aware, is to secure a supply of grass as long as possible through the winter, for he

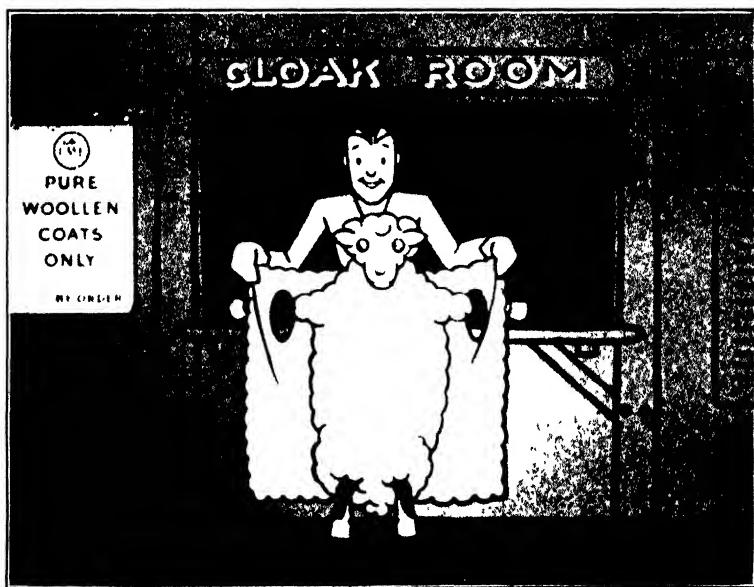
knows that he must look to out-wintering more and more for reasons both of farming economy and of the health of stock. Usually, he has to pin his faith to a pasture left rough in autumn. One eaten down bare in autumn and grazed intermittently throughout the winter has little stock-carrying capacity in the "dead" season and starts growth late in spring. Where, however, it has been well grazed, is manured in the early autumn, and then left unstocked for a couple of months, it will usually produce a fair abundance of fresh, green keep at a time when succulent herbage is scarce. The farmer knows that it is impracticable to manure all his winter grass, and has to content himself with a judicious blend of various treatments—rough pasture, bare pasture manured early and saved for a month or two, and Italian rye-grass helped along by nitrogen for earliest spring keep. Closely related to this question of out-wintering is that of the provision of shelter. The more farseeing are giving increased attention to the planting up of shelter belts; that is, in cases where the cheaper home-made shelters will not meet requirements.

NOVELTY is the breath of life to publicity, and the opportunity for novel advertising offered by such a popular medium as the comic film cartoon is one that cannot be ignored in a progressive and up-to-date publicity policy. Why should not the world of corn, cabbages and cows be given all the antics of Mickey Mouse and his brethren, and sent round the theatres to declare the especial virtue of the produce of the English farm and farmyard? It is interesting to note that the Empire Marketing Board has produced a comic film cartoon as a means of advertising home produce.

The Board's film, "The House that John Built," takes full advantage of the licence which is allowed in the fairy-tale world of the cartoon. John is the British producer and the House that is built is England—the England of sheep and pigs and orchards and dairies and harvests—but the scarecrow chases off the marauding crow with a pitchfork; the sheep takes off her woollen garments as a comedian divests himself of a dozen waistcoats; the pigs stage a banquet to fatten themselves magnificently for market; the cow supplies a magical milking pail from space, and so on. The produce of the land comes to the shops of England in aeroplanes, balloons and parachutes.



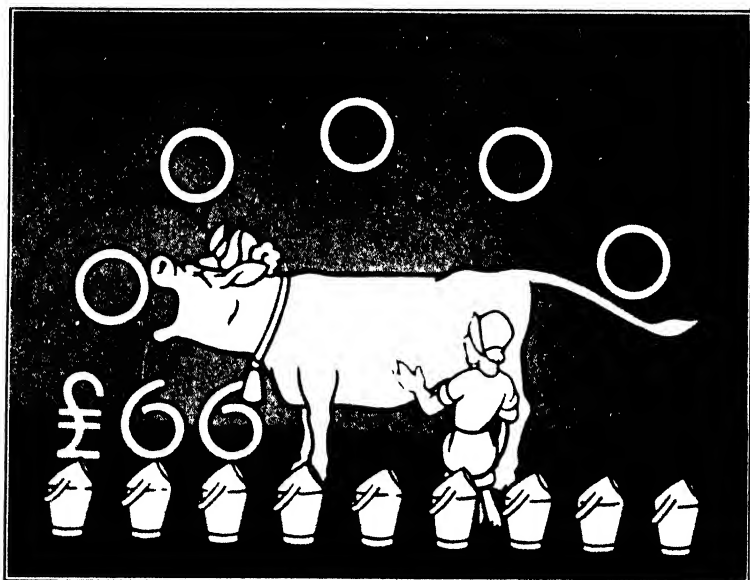
The scarecrow chases the marauding crow.



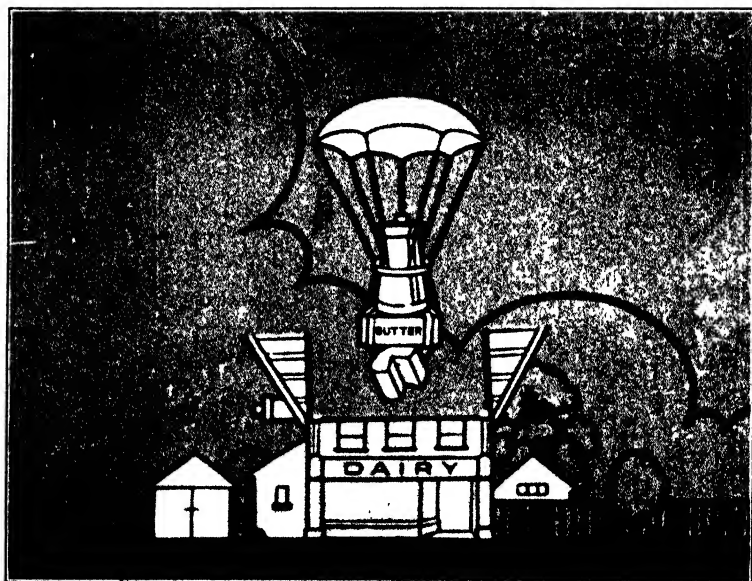
The sheep takes off her woollen garments.

"STILL" PICTURE INCIDENTS FROM THE FILM, "THE HOUSE THAT JOHN BUILT."

To face page 846.



The cow's magic milking pails.



The dairy produce arrives by parachute.

"STILL" PICTURE INCIDENTS FROM THE FILM, "THE HOUSE THAT JOHN BUILT."

The secret of the popularity of the cartoon film is the fact that it can be as fantastic as it pleases. Jumping over the moon becomes the very simplest and most obvious thing a self-respecting young cow can do. Given enough comic invention, the cow can become the really magnificent animal she is in the Mickey Mouse cartoons—a xylophone player, an orchestra conductor, a figure of tragedy pursued by maddened motor cars, or a ju-ju dancer in the jungle. The point for publicity is that, made alive in this way, she will sell her milk and butter and cheese the more cheerfully and effectively for it.

"The House that John Built" has already been shown by the Ministry at the Royal Agricultural Society's Show at Manchester this year, and at Leamington and Hereford in connexion with National Mark Weeks. It was shown by the Empire Marketing Board at the Imperial Fruit Show at Leicester, and is now included in the Board's library of films and will be used in the various types of non-commercial display in which the Board engages from time to time. Those who have an opportunity should not fail to see this entertaining and instructive film.

* * * * *

A NOTE on the Ministry's new series of Advisory Leaflets was published in the October, 1930, issue of this JOURNAL, p. 650. The following leaflets in this series have been issued since last spring :—

**Advisory
Leaflets**

- | | |
|-----|--|
| No. | 1. Tuberculosis in Poultry. |
| " | 2. Destruction of Charlock. |
| " | 3. Coltsfoot. |
| " | 4. Sheep Maggot Fly. |
| " | 5. Potato Scab. |
| " | 6. Blackquarter, Quarter Ill or Black Leg. |
| " | 7. Management of Bulls. |
| " | 9. Insecticides and Fungicides. |
| " | 10. Fruit Tree Red Spiders. |
| " | 11. Winter Moths. |
| " | 12. Mole Draining. |
| " | 13. Apple Sawfly. |
| " | 14. Sheep Nostril Fly. |
| " | 15. "Husk" or "Hoose." |
| " | 17. Swine Erysipelas. |
| " | 18. Cabbage Root Fly. |
| " | 20. "Blackhead" of Turkeys. |

The Ministry is now able to supply free of charge up to four leaflets on any one subject, *e.g.*, fruit growing ; diseases of animals ; manures ; insect pests ; fungus diseases ; weeds ; etc., with a maximum of 20 leaflets in all. Above these limits,

leaflets will be charged for at the rate of $\frac{1}{2}$ d. each, or 6d. per dozen, post free. If groups of leaflets dealing with related subjects are required, the Sectional Volume of Collected Leaflets or the Bulletin dealing with the subject should be purchased. A list of the Ministry's leaflets and priced publications will be sent gratis and post free on request.

It is not very generally known that a scheme is in existence whereby persons who wish to receive the Ministry's leaflets as issued, without special application, may do so on payment of a nominal registration fee. Reference was made to the arrangement in the July, 1928, issue of this JOURNAL, p. 309, but the fees payable have since been reduced.

For convenience the leaflets are divided into four main groups dealing with the following subjects:—

- I. Farm Live Stock (including Dairying, Feeding Stuffs, Pests and Diseases of Farm Animals).
- II. Small Live Stock (Poultry, Rabbits, Bees, Goats).
- III. Farm Crops (including Manures, Weeds, Pests and Diseases of Farm Crops).
- IV. Garden Crops and Fruit Growing (including Manures, Weeds, Pests and Diseases of Garden Crops and Fruit Trees).

The annual registration fees now payable are as follows:—

To receive New and Revised Leaflets						<i>per annum</i>
1.	Of any one or two groups	..	..	..	..	1s. 0d.
2.	Of any three or of all four groups	..	..	..	..	1s. 6d.
	*	*	*	*	*	*

THE Seventh Annual Conference of County and College Dairy Instructors and Instructresses in England and Wales, convened by the Ministry, was held on October 23 at the Civil Service Commission, Burlington Gardens, under the chairmanship of Mr. J. F. Blackshaw, O.B.E., the Ministry's Dairy Commissioner.

Dairy Instructors' Conference, 1930

In addition to county and college instructors and instructresses, there were present a number of county agricultural organizers and principals of agricultural colleges, the total attendance reaching 130. The Conference was opened by Earl De La Warr, Parliamentary Secretary to the Ministry.

Papers on the following subjects had been circulated before the date of the meeting:—

"Organized Milk Distribution by Producers," by Mr. F. N. Gingell, M.R.I.P.H., Manager, Harpenden Dairies, Ltd.

"Milk in Schools organized on a County Basis," by Mr. T. Hacking, M.Sc., Agricultural Organizer for Leicestershire.

"Courses of Instruction on Clean Milk for Health Visitors," by Mr. C. H. Westwater, M.A., B.Sc. (Agr.), Armstrong College, Newcastle-upon-Tyne.

"Some American Experiences," by Mr. R. Boutflour, M.Sc., Director of Dairy Husbandry, Harper Adams Agricultural College, Newport, Salop.

"A Travelling Dairy School in an Industrial Area," by Miss H. S. Wood, N.D.D., Instructress in Dairying, Nottinghamshire.

"Laboratory Control of Commercial Milk Supplies," by Mr. L. J. Walker, N.D.A., N.D.D., B.D.F.D., United Dairies (London), Ltd.

"Co-operative National Scheme for the Purchase and Sale of Milk," by Mr. G. Walworth, M.A., Dip. Agric. (Cantab.), Agricultural Organizer, Co-operative Union, Ltd.

"Some Cheese Problems," by Dr. A. T. R. Mattick, B.Sc., and Mr. J. G. Davis, M.Sc., National Institute for Research in Dairying, Reading.

Each paper was introduced at the meeting with a short address which was followed by open discussion.

THE Ninth Annual Conference of County and College Poultry Instructors was held on October 21 at the Civil Service Commission under the chairmanship of the Ministry's Poultry Commissioner, Mr. Percy A. Francis, O.B.E. **Poultry Instructors' Conference, 1930** Ninety-eight instructors, agricultural organizers, principals of colleges, and others were present.

Earl De La Warr, the Parliamentary Secretary to the Ministry, who opened the proceedings, spoke of the enormous strides made by the poultry industry during the last few years. Although the consumption of home-produced eggs had doubled, the importation of foreign eggs had not materially increased since 1913. There was ample scope for still greater home production, and the Ministry looked to poultry instructors to utilize the opportunities offered by personal contact with producers to capture more of the market at present held by imported supplies. Earl De La Warr also referred to the National Mark Scheme as part of the national effort for building up a demand for home produce, and to the Marketing Bill, which contained proposals for improving the marketing organization of the industry.

Professor R. T. Parkhurst, Director of the National Institute of Poultry Husbandry, contributed a paper on the possibilities of battery-brooding in this country. Mr. F. S. Dennis, Advisory Economist at Harper Adams Agricultural College, outlined a scheme for the collection of data on poultry costings. Mr. Tom Newman, of the Scientific Poultry Breeders' Association, spoke on intensive poultry keeping, and Mr. F. W. Bowers, formerly County Poultry Instructor for Essex, dealt with the development of day-old chick hatcheries. Mr. B. C. Brewer, Chief County Poultry Instructor for Somerset, and Mr. E. Russell, the Devon County Poultry Instructor, contributed papers on approved poultry breeding stations and the cockerel breeding scheme, both of which were referred to a select committee for the consideration of points of detail. All papers were followed by open discussion.

* * * * *

THE following note has been communicated by Mr. J. M. Templeton, B.Sc., Principal of the Farm Institute, Sparsholt, near Winchester :—

**Short Course
for Cowmen**

A member of the Hants Agricultural Education Committee made the suggestion that short courses of a week or less should be arranged for farm workers. This suggestion was acted upon and a short course for cowmen, of three days' duration, was arranged at the Farm Institute, Sparsholt. It was found that three days was as long as men in permanent employment could easily be away from their work, and although this period was considered too short to cover the ground satisfactorily, yet it was felt that good work could be done in the time.

The course for cowmen was planned (1) because of the very large dairying interest in the county, (2) because of the need to hold such a course before the busy, winter season began, and (3) because of the excellent equipment available at Sparsholt. The course was held from September 16-19, and the men resided in the hostel. A very satisfactory response was given, and 12 cowmen were enrolled. The fee for the course was 10s., and was in all cases paid by the employers. Most of the men were head cowmen, but all had had years of experience, and were supposed to "know their job."

The greatest difficulty was to frame a course of lectures and demonstrations in order to cover as much ground as possible in such a short period, and also because the capabilities of the cowmen were an "unknown quantity." The practical side was obviously important, and demonstrations therefore

formed a large part of the course. The equipment at Sparsholt is superior to that on the majority of ordinary farms, especially as three different milking-machine units are used, but the size of the dairy herd at that time was under 20 milking cows.

The general outline of the course was arranged to cover the whole aspect of sound management to maintain healthy herds for the production of clean milk. Work started at 7 a.m. and continued until 8 p.m. with breaks for meals.

The following is a summary of the lectures and demonstrations given :—

Feeding of cows and feeding stuffs	..	..	8 hours.
Clean milk production	..	..	4 "
Recording competition (clean milk and milking)	..	..	2 "
Sterilization of utensils	..	..	8 "
Milking machines	..	..	3 "
Milk secretion	..	..	1½ "
Veterinary lectures	..	..	2 "

The lectures were given by members of the Institute staff, with some help from the County Lecturers, and by a member of the staff of the National Institute for Research in Dairying. In all cases the lectures were supplemented as far as possible by charts, etc., and were followed by demonstrations. The practical work consisted of milking instruction, but more importance was attached to the cleaning of sheds and cows, and the style and method of milking. After milking was completed the men had to clean and sterilize all utensils used, *i.e.*, buckets, strainers, refrigerator, milking machines, etc., each man being given a separate job which was changed daily.

In the feeding of cows, considerable ignorance of the ordinary foods in use was shown, and very vague ideas of weights of foods and forage were general. A keen competition was arranged in which each man had to feed cows with varying weights of hay, straw and concentrates, these being checked on the scales.

In the evenings from 7–8 p.m. informal talks were held, when questions and problems were invited from the men, and this brought out much useful information, and the men realized the value of the discussions in dealing with each one's own peculiar difficulties.

Such a course, which must be regarded as of rather an experimental nature, showed clearly that the following conclusions may be drawn :—

- (1) That there is a demand among farm workers for increased knowledge in order to do their work more efficiently.
- (2) That this is a sound means of increasing the activities

of agricultural education in the county and getting into very close touch with the farm workers.

- (3) That the practical man is not always as careful as he should be, as, for example, in weighing out foods and carefully washing buckets. The general excuse, "there was not time," was shown, by better organization, to be untenable.
- (4) That such practices as wet hand milking, use of uncovered buckets, excessive feeding of roots and coarse fodders, etc., are difficult to overcome, but even the oldest men were willing to try other methods.
- (5) That even really good men find it very difficult to understand such things as "balanced rations," "coli in 1 c.c.," "sterilization," and so forth.
- (6) That the value of such courses cannot be truly estimated, as with the interest of the men aroused, and their confidence obtained in such totally different surroundings from those to which they are accustomed, one cannot help feeling that their quest for knowledge will increase, and that the majority of the men in the future will endeavour to get a better knowledge of their work. Men who are working in herds in the Clean Milk Competition were most keenly interested in bacteria and their effects on milk.
- (7) That the men attending such a course as this are better instructed by demonstrations than by lectures, as they can assimilate knowledge more easily through their eyes than by means of their ears.

In Hants we are convinced that such courses are most valuable, and they will be continued from time to time. The next course will be one for Poultrymen.

* * * * *

ACCORDING to returns made to the Ministry by the beet-sugar factories operating in Great Britain, the total quantity of home-grown beet sugar manufactured during October, 1930, together with the quantity produced during the corresponding month in 1929, was :—

**Production of
Home-Grown
Beet Sugar**

				cwt.
October, 1930	..	..	..	2,110,605
October, 1929	..	..	..	1,456,608

The total quantities of sugar produced during the two manufacturing campaigns to the end of October were :—

				cwt.
1930/1931	..	..	..	2,309,180
1929/1930	..	..	..	1,468,513

THE following table, which has been prepared from a statement issued by the Department of Agriculture for Scotland, shows the acreages of potatoes

Potato Acreages grown in Scotland in 1930 with corresponding acreages in 1929 :—

		1930 <i>acres</i>	1929 <i>acres</i>
Total acreage grown	.. ..	130,000	144,770
Total first earlies	.. ..	13,120	15,144
Total second earlies	.. ..	15,362	20,550
Total main crops	.. ..	76,953	91,278
Total unclassified	.. ..	24,565	17,798

Acreage figures for the most important varieties only are as under :—

FIRST EARLIES :—

Epicure	.. ..	7,703	7,939
Duke of York, etc.	.. ..	1,794	2,408
Sharpe's Express	.. ..	1,712	1,954
Eclipse, etc.	.. ..	948	1,794
Ninetyfold	.. ..	209	189
May Queen	.. ..	127	317

SECOND EARLIES :—

Great Scot	.. ..	10,059	13,777
British Queen, etc.	.. ..	3,518	3,530
Ally	.. ..	339	962
Arran Comrade	.. ..	331	404
Royal Kidney, etc.	.. ..	252	697

MAIN CROP :—

Immune

Kerr's Pink	.. ..	39,097	47,329
Golden Wonder, etc.	.. ..	7,986	6,716
Majestic	.. ..	5,657	7,537
Arran Banner	.. ..	678	278
Arran Consul	.. ..	617	1,610

Non-immune

King Edward, etc.	.. ..	15,146	15,324
Arran Chief	.. ..	3,035	5,812
Up-to-date, etc.	.. ..	1,195	1,657
Field Marshal	.. ..	434	479

The total area under potatoes in Scotland has decreased by nearly 15,000 acres. It is noteworthy, however, that, in the main crop varieties, the acreage under King Edwards has decreased only slightly, while Golden Wonder and Arran Banner have increased in area. In the second earlies, Ally has decreased in acreage by approximately 65 per cent. and Royal Kidney by approximately 64 per cent. as against a general decrease of about 10 per cent.

The Scottish estimates of yield for this year are not yet available, but for comparative purposes it may be stated that the preliminary estimates for England and Wales indicate a yield of 6·1 tons per acre in 1930 as against 6·9 tons in 1929.

THE annual dairy cow judging competition for Young Farmers' Clubs took place at the Dairy Show, by courtesy of the British Dairy Farmers' Association, on October 23, 1930. Nine teams contested for the *Farmer and Stockbreeder and Agricultural Gazette* silver challenge cup.

**Young Farmers'
Clubs : Annual
Dairy Cow
Judging Com-
petition, 1930**

The cattle judged were of the Dairy Shorthorn, Ayrshire and Jersey breeds, there being four animals in each ring. Maxima of 60 points were awarded for placing, and 60 points for oral reasons. Messrs. M. D. Bannister and W. Burkitt acted as judges, and Professor J. A. S. Watson as umpire.

The contest proved very interesting, and attracted the attention of many spectators throughout the day. The cup was won by the Buckingham Royal Latin School Calf Club ("A" team) by 758 points, Cuckfield Calf Club being runners-up with 748 points. The scores were as follows :—

	<i>Points</i>
(1) Buckingham Royal Latin School Calf Club ("A" team)	758
(2) Cuckfield Jersey Calf Club	748
(3) Horsham Calf Club (Holders, 1929)	740
(4) Buckingham Royal Latin School Calf Club ("B" team)	734
(5) Northumberland Calf Club	712
(6) Bletchley Calf Club	593
(7) Collingham Mixed Club	590
(8) United Dairies Kingsclere Calf Club	550
(9) Withleigh Mixed Club	520

In the individual scoring the top place, with the award of the silver medal of the British Dairy Farmers' Association, was secured by John Arnison of the Northumberland team with 267 points. Thomas Busby of the Buckingham Royal Latin School, "A" team, was a close second with 264 points, and two girls, Thirza Hobgen and Elsie Tidy, of the Horsham Calf Club and Cuckfield Jersey Calf Club, respectively, tied for third place with 262 points. The bronze medal of the British Dairy Farmers' Association was awarded to each of these three competitors.

The cup and medals were presented to the winning team and competitors by Lord Daresbury, C.V.O., who complimented all the teams and competitors on their efforts.

THE BIOLOGY OF SEEDS

Sir J. ARTHUR THOMSON, M.A., LL.D.,

*Emeritus Professor of Natural History in the University of
Aberdeen.*

It is a sight to see a great heap of wheat in a granary, or a living cataract pouring down a chute into the hold of a grain vessel. A living cataract! That is part of the thrill, for each of these grains of wheat is a living embryo, as well as a condensed store of chemical energy which man and beast can quickly turn into work and warmth. As we let the grains trickle through our fingers, it is interesting to think of our prehistoric ancestors who probably noticed the big kernels of the Wild Wheat growing on the shoulders of Mount Hermon, and set them apart for cultivation. This was doubtless the beginning of that long patience which led to such first-class wheats as Marquis—surely one of the factors that won the War.

It is still more thrilling to think back and back to the ages when there were no seeds whatever, for it seems certain, judging from the fossils, that there were no seeding plants before the time of the later Devonian or Old Red Sandstone. There were many plants before that, but they were not seed-bearers. How they multiplied without seeds is a difficult question, to which we shall return at the end of this article. It is at present enough to notice that none of the flowerless plants such as ferns and horsetails, mosses and liverworts, have any seeds in the true sense. These are confined to Flowering Plants.

The True Inwardness of Seeds.—Botany books often tell us that seeds are “the ripe ovules”—the outcome of the full growth of the small, whiteish bodies that we find inside the seed-box (badly called the ovary) of a flower. This definition is true enough, but does it not rather conceal the open secret that the seed is or contains an embryo, just as a fertilized egg does when the hen has brooded on it for a while? When we open a pea-pod and examine one of the seeds, we soon discover that it consists of two plump seed-leaves laden with stores of food, and that between these there is a tiny stem (plumule) and root (radicle), which will by and by sprout and grow. To understand how this embryo-plant came to be requires long study, but we must be content here to be very clear about the main fact that the embryo-plant developed, inside the “embryo-sac” of the ovule, from a fertilized egg-cell, just as if it were an embryo-animal. Thus a seed turns out to be a very young plant, usually well equipped with reserve

food-material (on which we so largely depend), and usually surrounded by firm protective envelopes. As the developing seed remains for some time in close union with the parent plant, from which it gets its food-materials both for growth and for storage, it may be compared without fancifulness to an embryo-mammal developing inside its mother's womb or uterus. In short, mammals and flowering-plants have achieved *viviparity*; that is to say, what is liberated from the parent is a young creature, already more or less advanced in development.

The Fitnesses of Seeds.—Every living creature that is at all complicated may be described as “a bundle of fitnesses,” and although a seed is only beginning to live it shows many of these fitnesses or adaptations, some of them so intricate that long ages must have been needed for their gradual perfecting. Thus some seeds are particularly fitted for being scattered or sown. In most cases this is due to the fruits, which may explode—like the pods of whins and broom; or may be borne away on the wings of the wind—like the nutlets of dandelion- and thistle-down; or may attract the hungry eyes of birds, with the result that the undigested seeds are scattered far afield; or may adhere for a while to passing animals, as butter-burrs to sheep or cleavers to rabbits. In many a case, however, it is the seed rather than the fruit that is adapted for being scattered. Thus the hairs that form parachutes may be attached not to the fruits, but to the seeds, as in the case of cotton; or the outer wall of the seed may be almost water-proof, so that long floating in the sea may be possible without injury; or the outside of the seed may become gluey when wetted, so that fixation in suitable moist soil is readily effected. In many other ways the seeds are fitted for being sown, and this is just one instance of their adaptations. We must also inquire into their fittedness for lying low, their fittedness for resisting injury, and their fittedness for sprouting when the time comes.

Lying Low.—We must confess that we have never got rid of a feeling of mild surprise when we look round a seedsman's shop and see the bags of dry seeds—all, or nearly all, *alive*. There is no need to be ashamed of this wonderment, for no biologist understands as yet the state of latent life into which many living creatures are able to sink without dying. Active living matter usually contains at least 75 per cent. of water; but many seeds are dry and hard. Active living matter is in a colloidal state, *i.e.*, with innumerable particles or droplets

suspended in a fluid medium, but there is not much hint of this in dormant seeds. It must be remembered, however, that a great part of a seed may consist of stored food that never has much life about it, and does not develop into living tissues as the embryo itself must do.

In some of the higher animals, such as the badger, the fertilized egg-cell develops for a time into an embryo, and then stops for a long rest. Among the lower animals, also, this resting is not uncommon, and in the plant world it is particularly characteristic of seeds. They develop up to a certain point, and then they stop and do not begin again till they are getting ready for sprouting. It is natural enough that there should be a resting time after a period of development—life has many of these see-saws—but the quiescence may be thought of in other ways as well. Thus it might be very disadvantageous if the embryo-plant grew too big for the ovule or for the seed-box; and we must not too hurriedly say “Impossible!” for the embryo of the mangrove-tree develops so vigorously inside the fruit that it protrudes and falls off into the seashore mud. This works well for the mangrove, but it would be ruination in most plants. It may also be that after the ripening of the fruit and the withering of the flower there is little food available for the seeds.

In any case, it seems good sense to say that, for most plants, those kinds have succeeded whose seeds passed into a state of *arrested development*. This made it possible for the seeds to wait till the season was suitable for sprouting, or till they were sown in a suitable place. No doubt there are some seeds that usually germinate without a long rest, as in the case of willows, crucifers and grasses; but it seems safe to say that for most plants it is advantageous that their seeds should be able to lie low for a considerable time. It gives the seeds increased chances of life if there is no need for hurry, if they can simply wait for spring or until they are carried to a more suitable place. And if the embryo-plant can wait in a state of arrested development, that makes it more possible to have very protective envelopes and a very condensed and hard legacy of food.

If it be said that the embryo-plant *simply has to lie low* because of the hardness of the surrounding tissue and the seed-coats, and because of the unsuitable soil and weather, the answer is that this is not confirmed by the experiments of artificially removing the hard envelopes or of placing the seeds from the first in artificially hospitable conditions. More-

over, some seeds germinate best after more than one winter's dormancy. There seem to be deep advantages in a prolonged "lying low."

Tenacity of Life in Seeds.—Among the many errors that die hard is the sprouting of "mummy wheat." Man dearly loves a touch of the magical, and he is unwilling to give up the picturesque belief that wheat from inside a mummy-case may sprout after thousands of years of dormancy. There is the story of the man who bought some "mummy wheat" in Egypt and sowed it in Australia, where it germinated and grew with great vigour. There are many such "records," but in every carefully conducted scientific experiment the true mummy-wheat has refused to sprout at all. What happens in the ordinary popular experiments is the sprouting of *faked* mummy-wheat, that is to say, of modern seeds substituted for the ancient ones. The supply has to meet the demand; and we have heard that the alleged mummy-wheat sometimes grows into a variety that was not known in the time of the Pharaohs, but evolved in the early twentieth century! In any case, it may be safely said that if mummy-wheat germinates, it is not true mummy-wheat. So that's that.

At the same time it is certain that seeds may remain alive for many years. Thus, Becquerel proved that some seeds germinated after resting for eighty-seven years in a herbarium—a *hortus siccus* indeed. As regards the Sensitive Plant, a dormancy of sixty years has been demonstrated. In most cases, however, a tenth of that period would be considered a long dormancy; but it would be interesting to have fresh data on this subject from practical men, such as seedsmen, gardeners, and farmers. Different kinds of seeds differ in their power of lying low, and much may also depend on the nature of the medium in which they lie. It has often been noticed that the re-digging of a forsaken cottage-garden is followed by a reappearance of old-fashioned flowers that had not been seen there for years; but care must be taken to show that the reappearing flowers came from seeds that had been lying dormant and not from underground stems or the like which were stimulated by the exposure. Allowance must also be made for the possibility of some fortuitous fresh sowing, *e.g.*, of seeds included in the manure dug in, or of seeds carried on to the freshly dug soil by the wind, or on the feet of birds.

Protective Husks.—Seeds normally come to an approximate standstill in their development, being in a state of arrest when they are liberated; the quiescent state may be prolonged

after sowing, sometimes for a considerable period in natural conditions or for a still longer period in experiments. Yet a little more must be said in regard to the frequent insusceptibility of seeds to untoward external influences. This is familiar in Nature, where seeds often land in very unsuitable places, such as little crevices in a wall, and yet do not die; and more striking data have been furnished by experiments—by those of Becquerel in particular.

The life of the embryo within the seed is anything but assertive, and yet it is strangely tough. One reason may be found in the seed-envelopes which allow of little diffusion as long as they are dry. Becquerel fitted pieces of the tough seed-coats of peas and beans on the top of a tube of mercury, above a Torricellian vacuum, and found that no air was drawn through, even in the course of months. The seed-envelopes are gas-proof, as long as they are dry. When they are soaked in water, however, they show the gaseous absorption that one would expect.

In other experiments Becquerel showed that, in addition to the insulating seed-coats, there is extraordinary resisting power in seeds themselves. He perforated the envelopes of the seeds of wheat, mustard and lucerne, and subjected them to very inhospitable conditions without robbing them of their capacity for sprouting. Some of the trials which they withstood were extraordinary. He dried them in a vacuum at 40° C. for six months; sealed them up in an almost exhausted vacuum tube for a year; submitted them to the temperature of liquid air (−190°) for three weeks, and of liquid hydrogen (−250°) for three days; after which he put them on moist cotton wool—where they germinated as usual! Becquerel concluded that there was a complete cessation of the kind of activity we call “life”—which implies on its chemical side the down-breaking and rebuilding of proteins and other complex carbon-compounds. It is difficult, however, to call a seed “dead” if it can eventually sprout; all that we can say is that seeds may lose all signs of life without really dying.

Condensed Food.—Seed-plants proved very successful in the struggle for existence, partly because what was launched on the voyage of life was already a young creature; partly because of the perfection with which the seed-coats shut out injurious influences and enabled the embryo to lie low for a long time if need be; and partly because of the legacy of condensed food which was placed at the disposal of the young plant at the critical time of germination. This food is sometimes

in the embryo itself, sometimes in the embryo-sac, and sometimes in the surrounding ovule tissue; it may be large in amount as in wheat, or in small quantity as in orchids; it may be starchy, sugary, fatty or, best of all, proteinaceous; it may be softish or firm or, in rare cases like dates, almost as hard as bone. There are seeds and seeds. The most important biological facts are two: (1) that this legacy is very condensed, that it does not readily "go wrong" as long as the seed-coats are intact, but that it is fermented into fluid form before the time of sprouting; and (2) that it makes it possible for the sprouting young plant to resume development and growth until it is able to fend for itself by absorbing food from the soil and the air. If man had thought out the device of seeds, he would have been very proud of his invention!

The Evolution of Seeds.—We have left this question to the end, because even an outline of an answer is undeniably difficult; but it is well worth while to try to get hold of the clue. For many millions of years after plants began there were no seeds, the first seed-bearing plants making their appearance in the Upper Devonian Period amid the ferns and other plants of the flowerless forests. If we ask how there could be successful plants without any seeds, we may get the beginning of an answer if we take a withering fern-frond and shake it over a sheet of paper and notice the shower of "spores," which used to be called "fern-seed." These spores, however, are very different from seeds, being single cells, as light as air, whereas seeds are already embryo plants.

It is impossible, however, to stop here, for if we are able, *e.g.*, in a greenhouse, to watch a spore that sinks on to the moist soil we can see that it develops into a minute green disc, often about half the size of a threepenny piece. This inconspicuous disc or prothallus is actually the sexual fern—in great contrast to the asexual or spore-bearing fern with which everyone is familiar. On the under surface of the disc there are minute male and female reproductive organs, and, as is usual among living creatures, the egg-cell is fertilized by a sperm-cell and begins to develop into an embryo-plant, although this does not form a seed in ferns or in any of their (cryptogam) allies. In ferns it grows up from the prothallus and gradually develops into the spore-bearing fern-plant. This is what is called "alternation of generations"—the alternate occurrence in one life-history of two different forms differently produced. In the fern life-history the sequence is: Spore-bearing Fern—Spore—Prothallus—Egg-cell and Sperm-cell—Embryo—

Spore-bearing Fern. In this, however, there is nothing quite comparable to a seed.

It was not till about 1850 that botanists saw how to relate the ordinary flowering plants to the flowerless forms like ferns and horsetails, mosses and club-mosses. It was then that a genius, Wilhelm Hofmeister, had the insight to discern and the skilled patience to prove that the ordinary flowering plant is a spore-bearer, that has incorporated and well-nigh suppressed the sexual generation.

It is a difficult story, but a beautiful one, that the stamens and carpels of the flower are transformed spore-bearing leaves, that there are two kinds of spores—the pollen-grains made in the anther and the embryo-sac that is hidden away inside the ovule within the ovary. As far as the pollen-grain is concerned, the sexual generation (like a fern's prothallus) is restricted to the formation of three nuclei, one of which fertilizes the egg-cell. As far as the embryo-sac is concerned, the sexual generation (again like the fern's prothallus) is restricted to three cell-divisions in the embryo-sac, one of them resulting in an egg-cell.

From the fertilized egg-cell an embryo-plant develops, surrounded by more or less nourishment, while the outer walls of the ovule result in the protective envelopes. Thus we account for seeds, which began to be formed in certain extinct pioneering plants, many millions of years ago. The pioneer seed-bearers made their appearance in the Upper Devonian, as we have said, and became exuberant in the Carboniferous Period, when the coal-measures were laid down. They are called Seed-Ferns, or Pteridosperms, or Cycadofilices, the last name meaning that they show a combination of Cycad-like and Fern-like characters. They made one of the most important steps in the whole story of evolution. Where would Man be without seeds !

We are not pretending that it is at present possible to describe the precise steps by which the first seeds began millions of years ago, but Hofmeister discovered the main clue—that the spore-bearing generation incorporated a dwindling sexual generation ; and Professor Bower has discovered another clue, that the ascendancy of the asexual "sporophyte" and the dwindling of the sexual "gametophyte" is to be associated with increased adaptation to terrestrial conditions. Dry land does not afford such a safe and soft cradle for egg-cells and embryos as the water does. Hence the great advantage of well-mothered seeds, which are not set adrift till they are relatively advanced.

Moreover, the fertilizing elements—the male-cells—of ferns and their allies are active ciliated cells, able to reach the egg-cell by swimming in water-containing spaces, *e.g.*, under the prothallus. But how difficult this would be in ordinary flowering-plants—a difficulty evaded by having insect-carried or wind-borne pollen-grains that adhere to the moist stigma of the flower, and send out a long pollen-tube feeling its way down the style towards the distant egg-cell in the embryo-sac. The fertilizing male element in the flowering plant is a nucleus that travels down the pollen-tube.

The long story should become vivid when we notice the remarkable discovery that out of the pollen-grain of Cycads and the Maiden's Hair Tree there come two or more motile spermatozoa or male-elements, very like those of ferns and their allies. We give flowering plants the technical name of Phanerogams, which means "with conspicuous sex," in contrast to Cryptogams "with hidden sex." The fact of the matter is that in flowering plants the whole of the true sex-generation has been so thoroughly hidden away that it needs a botanist to find it. But it was this that led to seeds!

* * * * *

THE CONTROL OF WARBLE FLIES IN NORTH WALES

W. MALDWYN DAVIES, B.Sc., Ph.D.,

Adviser in Agricultural Zoology, University College of North Wales, Bangor.

THE problem of warble fly control is receiving the serious attention of the agricultural community throughout Great Britain. So much has been heard lately of the widespread losses which take place annually through the ravages of this pest that it is not intended to elaborate this aspect of the subject. On the other hand, farmers, appreciating the considerable damage caused by the warble fly, are becoming desirous, should economic factors permit, to join in any campaign initiated to bring about an effective control of this pest.

Infestation of Warbles in 1930.—It was anticipated after the fine, early summer of 1929 (rainfall in Bangor district from April to July, 8·45 inches) that the infestation of warbles in 1930 would be high. In the Bangor district, warbles began to appear on the backs of cattle as early as the second week in January. That this date is exceptionally early is evident from data obtained by Walton¹* who, working in the same

* For references, see page 870.

area, writes "exceptionally early larvæ are now and again observed; one February 11, 1921, and another February 27, 1924." The size of larvæ was comparable. In the present observations in another district—Pwllheli—the infestation on February 11, 1930, is indicated by counts on two farms:—

FARM A (low-lying, wooded): 23 cows examined; 21 infested, averaging 5 warbles per animal (gross av. 4.5).
31 young fattening cattle examined, all infested, averaging 11.5 warbles per animal.

FARM B (high-lying, wooded): 16 cows examined; 14 infested, averaging 2.5 warbles per animal (gross av. 2.2).
9 young fattening cattle examined, all infested, averaging 11.3 warbles per animal.

Later in February, opportunity was afforded, under a large-scale demonstration scheme carried out in conjunction with the Madryn Farm School, for the examination of all cattle from the extreme point in the S. Caernarvonshire peninsula to about three miles inland. Thus, on February 24, 25 and 28, 243 cattle were examined in this area and 188 of these proved to be infested at this early date. The average number of warbles on the infested cattle (all ages) was 15.4 per animal (gross average 12.0) varying from 1 to 69.

This average at so early a date is abnormally high, for during Walton's observations (1920-1926) the highest (gross) average throughout the season was 9.14 warbles per animal, found in 1923 (rainfall during previous April to July 9.93 inches). Further, the highest average (gross) count taken in any one herd during those years was 13.8 warbles per animal on 14 young cows in 1926, whereas in the present observations in the S. Caernarvonshire area, at this early date, the average on a single herd of 18 animals (all ages) was 20.2 warbles per animal, while actually, on one small holding, the cattle, viz., 2 cows, 1 heifer and 1 bullock, gave an average of 32.5 warbles per animal! As all cattle in this district were subsequently dressed it was not possible to obtain comparable counts at a later date. This early and high infestation, however, was not confined to the S. Caernarvonshire and Bangor district, for, on March 4, a herd in Anglesey, comprising 11 cows and 7 yearlings, gave an average of 12.4 warbles per animal. Observations on cattle throughout N. Wales showed that the high infestation was general, and butchers have stated that it was one of the worst years for "warble damage" within their memory.

On observation cattle, *Hypoderma lineata* larvæ commenced to leave the back in the second week in March. With an

early infestation, it was hoped that all larvæ would have left early, thus making it unnecessary to carry out a late dressing. Unfortunately, this was not the case for, when the cattle in the S. Caernarvonshire area were examined on June 30, it was found that of 30 cattle examined, which had been treated with derris powder wash a month previously, 16 animals still had warbles, averaging 2.6 per infested animal. This point was important in an area where total eradication was being attempted, and it became necessary in the area to carry out the last treatment at this date.

Treatment of Cattle.—In addition to the aforementioned large-scale demonstration scheme, in which the ultimate results will become evident only after next and subsequent years, trials have been conducted for several years in North Wales with the object of selecting an efficient insecticide which could be recommended for general use against the warble fly. Walton,² following up the work of Bishopp³ and others, had tried iodoform and vaseline, also derris powder and vaseline; these gave very promising results. The use of these ointments met the need of the, then, comparatively few farmers who were anxious to destroy the warbles, particularly on fat or dairy cattle. With a realization of the extensive losses due to the warble fly, there has come a general demand on the part of the agricultural community in the province for a method which can be applied easily on a large scale, and which aims at the eradication of the fly over large areas.

This demand was welcomed because the work of Bishopp and others had pointed clearly to the most promising insecticides for the destruction of warble fly larvæ, and it remained for the farmers to request that large-scale experiments be carried out to combat this pest. Anticipating such a demand, the writer has, for the last three years, carried out tests with materials likely to meet this need. The need is not only for a material that is cheap, easily applied, harmless to animals and odourless, but that is also highly effective *under ordinary farm conditions*.

Some of the materials tried were useless; others, though efficient, were too expensive or, while efficient under experimental conditions, did not give satisfactory results under ordinary farm conditions. The high toxicity of derris powder wash for the destruction of warble fly larvæ had been proved by Bishopp and others, and was further demonstrated in the Worcestershire experiments.⁴

Derris powder, of course, is the dried and powdered root of a tropical plant (*Deguelia*) of which there are several species. McIndoo⁵ had shown that of eight powders used as "dusts" only three species were efficient as insecticides, whereas Fryer, Stenton, Tattersfield and Roach⁶ showed that even supplies of derris from the same source may differ in toxic properties. Hence it appeared very necessary that the farmer should be guarded against buying derris powder which was useless for the destruction of warbles. It was, therefore, decided to carry out tests to ascertain the toxicity of derris powder wash made with derris obtained from various sources. Obviously, these sources should be those from which the farmers would normally obtain their supplies; hence derris was bought from local chemists and from firms who supply the local chemists in the different districts in N. Wales.

Method of Preparation and Application.—The wash was prepared according to Bishopp's formula (see also Advisory Leaflet⁷), viz., 1 lb. derris powder, $\frac{1}{4}$ lb. soft soap, 1 gallon water, the soft soap being first dissolved in a little hot water, then the quantity made up with cold water to a gallon and poured on to the powder. The resultant liquid (which must be thoroughly and periodically stirred) is a thick fluid with the derris powder in suspension. This was applied to the warbled area on the back of each animal, first of all by dipping a stiff cane brush in the solution and scrubbing the back to remove the crust around the warble hole, and following this by swabbing the warbles with a piece of soft cloth soaked in the liquid. Evidence was forthcoming that the wash will not retain its toxicity if kept more than a day or so after it is prepared.

Four monthly dressings proved necessary this season—commencing March 13-20 and ending June 20-July 4. There is some evidence, however, that the initial date of emergence of larvæ from the back might be of seasonal variation, and this is a subject of further inquiry.

Method of Experiments and Estimation of Results.—In the trials carried out previously, an opportunity was provided for arriving at a technique which would give reliable and comparable results.* It was found necessary to divide the trials into three distinct categories, as follows:—

DIVISION 1.—Critical experiments devised to ascertain the relative toxicity of the different materials when applied under ideal conditions favouring the materials. These were carried out

* A memorandum, giving details of the methods employed, has been prepared separately from this paper.

on 64 animals, and the writer undertook both application of materials and the counting of results. In this division, a careful map was made of each animal's back showing the position of each warble treated, while, in addition, the hair was clipped to mark the treated warbles. Animals with few warbles, or with warbles well distributed, were chosen for these critical trials, to ensure that the treated warbles could be detected with ease. Untreated warbles were marked as "controls" in the same way by clipping the hair and mapping.

DIVISION 2.—In these tests, the writer again undertook the application of material and the counting of the results, but the cattle were treated under general farm conditions as, for instance, when 150 untied cattle were dressed.

DIVISION 3.—Here the farmer was responsible for the treatment and the writer made the count of the percentage killed.

In this way, it was possible to test the efficiency of each material, (1) under ideal conditions when the actual toxicity could be ascertained; (2) under general farm conditions, when any variation due to personal error was eliminated; and (3) under ordinary and varied farm conditions.

The method adopted for obtaining the results is important, for, with the subsequent appearance of larvæ after treatment and, later in the season, the emergence of larvæ, unreliable and misleading results might easily be obtained. In the first place, there is the natural curve of prevalence of warbles from nil in the late autumn to a maximum in March or April (varying according to species, season, etc.) and then a subsequent decline. Hence, if a count is made of the number of warbles present at each monthly dressing, the natural decline in the number of the warbles per animal as the season advances might be mistaken for the effectiveness of the treatment. While this could partially be checked by retaining untreated animals as controls, such "controls" cannot be kept in areas where the destruction of all warbles is desired.

In the present trials, it was shown that if the examination was made at shorter intervals the experimental error was reduced to a minimum. It was found that the optimum period for observation was 15 days, for the killed warbles were then in a moderately advanced stage of decomposition, whereas larvæ which had pierced the skin after treatment were small enough to be counted as "subsequent appearances." Where necessary, a confirmatory count was made 21 days after treatment. Warbles that have been killed can be detected either by the black protruding portion of the warble from which may be extracted, by pulling, the complete black dead larva (see Fig. 1); or, later, when the protruding portion has been reduced to a mere black point it is then flush with



FIG. 1. Warble Fly larvæ destroyed by derris powder wash.



FIG. 2. Warble Fly larvæ beneath the skin of a cow.

THE CONTROL OF WARBLE FLIES IN NORTH WALES.

To face page 806.

the top of the orifice as compared with the live larva which (except just before emergence) lies slightly below the level of the orifice (see Fig. 2). Further, there is usually a yellowish exudation around the hole of a live larva. In other cases, where advanced decomposition has set in, the dead larva is enveloped with pus. In addition, previous experience had shown that it was advisable to carry out trials during February, March and early April before the general emergence of *H. lineata* takes place.

In the critical trials (Division 1) about 100 warbles were treated with each material and, at examination 15 days after treatment, no larva was marked "killed" unless removed *dead*.

In Division 2, a count was made of the number of warbles per animal before treatment, and 15 days later a count made of the number of *live* larvæ, which was checked by a count of the number of killed larvæ.

In Division 3, the cattle were visited 15 days after treatment and a count made of both *dead* and *live* larvæ, and the percentage kill was estimated from this. That the materials which proved inefficient in the critical trials in Division 1 simultaneously proved inefficient in Division 2 and Division 3 points to the reliability of the method adopted. Further, the handling of the cattle after treatment furnished ample confirmatory evidence that the counts taken were reliable.

Results of Experiments.—The materials used were as follows :—

1. *Derris powder from Source "X."*—This powder was buff colour, finely ground, and purchased at the retail price of 3s. 6d. per lb.

2. *Derris powder from Source "Y."*—A coffee-coloured powder, fibrous, purchased at the retail price of 2s. 3d. per lb.

3. *Derris powder from Source "Z."*—This powder was chocolate colour, fibrous, and purchased at 3s. 4d. per lb. It was claimed to be "biologically standardized."

4. *Derris powder from Source "Q."*—A fawn-coloured powder, finely ground, and purchased at 3s. per lb.

5. *Wash "A"* (containing essential elements of derris).—Thick solution, purchased at 5s. 3d. per pint to be diluted 1 in 7.

6. *Wash "B."*—As "A" above, but prepared on a less frothy base (not available in market).

The results in the critical tests (*Division 1*) are set out in the Table I.

Controls.—At each farm, and in each treatment, a number of warbles (approx. 10) was left untreated, and mapped and marked for future detection. These were examined 15 days later along with the treated warbles and removed in order to

TABLE I.—CRITICAL TESTS

<i>Material</i>		<i>Cattle treated</i>	<i>Warbles treated</i>	<i>Warbles killed</i>	<i>Warbles killed</i>
		No.	No.	No.	per cent.
"X" (powder)	..	12	93	93	100.0
"Y" "	..	13	108	83	76.8
"Z" "	..	12	104	103	99.03
"Q" "	..	15	106	106	100.0
"A" Wash	..	12	99	74	74.7
"B" "	..	18	80	32	40.0

ascertain if they were alive. All such warbles proved to be alive save in a few cases which had obviously been hit by the horn of the animal and destroyed, when inflammation frequently followed. The results obtained in the general tests (*Division 2*) are given in Table II.

TABLE II.—GENERAL TESTS (*Division 2*)

<i>Material</i>	<i>Cattle treated</i>	<i>Warbles before treatment</i>	<i>Warbles after treatment</i>	<i>Warbles killed</i>
	No.	Av. No.	Av. No.	per cent.
"X" (powder)	25 yearlings (untied)	23 (15-56)	no live warble found	100
"Y" "	35 yearlings (untied)	22 (8-61)	16 (0-25)	27.3
"Z" "	(not included)	—	—	—
"Q" "	20 fat cattle (untied)	11 (5-26)	no live warble found	100
"A" Wash	22 yearlings (untied)	18 (7-31)	12 (0-22)	69.9

The results obtained under ordinary and varied farm conditions can obviously only be of a general character, but are valuable in conjunction with the foregoing. They are described as follows:—

TESTS UNDER ORDINARY FARM CONDITIONS (*Division 3*)

Material "X."—Many farmers had used derris powder from source "X," and 5 farms were visited 15 days after treatment in order to obtain a count of the efficiency of this material. On four of the farms a 100 per cent. kill had been obtained, for no live larvæ could be found. On the remaining farm a few live larvæ were found, but these were in unusual positions and no doubt had missed the dressing.

Material "Y."—This derris powder had only been used at a few farms, and 5 such were visited 15 days after treatment. It was very evident on handling the cattle that this derris had failed to produce a satisfactory kill and on a count being made the average kill was 40, 20, 20, 30 and 20 per cent. respectively (counts given to nearest 10).

Material "Z."—This derris powder was used mainly in the demonstration area, so that ample opportunity was available for estimating its efficiency under ordinary farm conditions. On most farms a 100 per cent. kill was obtained, and where this was not secured faulty application or preparation accounted for the results. This was adjusted at subsequent dressings.

Material "Q."—Only three farms supplied the data for the efficiency of derris powder from source "Q." At all these farms a complete kill was obtained.

Material "A."—This wash was used on a large number of farms, and about 20 were visited in order to obtain data regarding the efficiency of this material. It was very evident, on handling the cattle where this wash has been used, that the results did not come up to expectation. Five farms on which counts were made yielded 50, 75, 75, 40 and 75 per cent. of warbles killed.

Material "B."—This was not on the market.

Summary of Results.—The bulk of the derris powder sold to farmers in North Wales during 1930 was supplied from four different sources; powder from these sources was used in the trials along with two proprietary washes. When it was used as a wash, derris powder from three of the sources proved highly toxic to warble-fly larvæ under critical, general and ordinary farm conditions. Derris powder from the remaining source, while yielding a moderately high percentage kill under the critical tests which ensured sufficient solution entering each warble hole, failed to produce an effective kill under general and ordinary farm conditions. The writer is pleased to add that, in the case of the latter powder, the firm concerned, on being notified of these results, stated that no further supplies would be obtained from that source.

A solution which need only be diluted with water before application has, for obvious reasons, a distinct advantage over a powder, and it was hoped that a solution which was available would be found effective. Unfortunately, the only wash available for these tests failed to give more than 75 per cent. kill under ordinary farm conditions. It was at first thought that the frothy nature of the wash on application prevented the entrance of the solution; but a second sample was received which had been prepared on a less frothy base and showed no greater efficiency.

Cost of Application.—Derris powder, highly toxic to warble fly larvæ, was obtained last season at a retail price of 3s. per lb. This was sufficient to make 1 gallon of wash. The number of cattle that can be treated with 1 gallon of wash obviously varies with the degree of infestation with warbles, the care taken in application, etc. In the general tests (Division 2) above, with a heavy infestation, 1 gallon was sufficient to dress 50-60 cattle once. This was the initial dressing and naturally less wash would be required at subsequent dressings.

It is estimated, from the work in the Demonstration Scheme where small herds were involved, that 1 lb. of derris powder is sufficient to provide wash for four monthly dressings on a

farm with 20-25 infested cattle. On this basis, the cost for four monthly treatments should not exceed 2d. per animal.

Discussion.—From the preceding trials, it is evident that the farmer has at his disposal materials which, with ordinary care, are highly efficient in the destruction of warble-fly larvæ when applied under ordinary farm conditions. Derris powder wash is particularly suitable for this purpose, but, whereas most of the derris available to the farmers is highly toxic, the farmer must beware lest he obtains derris which is valueless for the destruction of warbles. Although, last season, few firms could give a guarantee of toxicity it should be possible in future to obtain such guarantee provided the firm can state that the derris was obtained from the same source or that it has been subsequently tested.

With the existence of an efficient and inexpensive insecticide, the control of the warble fly now depends very largely upon the co-operation of farmers in organized anti-warble fly campaigns. The advantage of treating cattle over large areas is obvious. During a period of agricultural depression, however, no additional expenditure upon insecticides will be undertaken unless prospects of a quick return are forthcoming. The farmer will receive the immediate benefit through the better condition of his treated cattle and he will also reduce the losses resulting from the "gadding" caused by the fly. The monetary value of these factors, unfortunately, is difficult to estimate, but several farmers who dressed their cattle for the first time this season have expressed the opinion that there was a decided improvement in the condition of the cattle after treatment. Further, there is evidence that the local butchers and dealers are fully alive to the situation and are prepared to pay 10s. to 20s. more for a non-warbled beast. These factors should encourage farmers to join in an anti-warble fly campaign.

Acknowledgments are due to the Agricultural Organizers of the counties of Caernarvon, Anglesey and Denbigh, and to Mr. Edwin Jones, M.Sc. (Madryn Farm School), for their co-operation in trials under the heading of Division B.

REFERENCES CITED

- ¹ Walton, C. L. (Jan., 1925), *Welsh Journ. Agri.*, Vol. I, p. 195.
- ² do. (Jan., 1927), *Ibid.*, Vol. III, p. 164.
- ³ Bishopp, F. C. (April 1926), *U.S.D.A. Dept., Bull.* No. 1369.
- ⁴ "Ox Warble Fly Report," *Worcester Agri. Educ. Comm.*, Oct. 1929.
- ⁵ McIndoo, N. E., *Jour. Agri. Res.* (Wash.), Vol. XVII, No. 5., p. 177.
- ⁶ Fryer, Srenton, Tattersfield and Roach, *Ann. Appl. Biol.* Vol. X, No. 1., p. 18.
- ⁷ "The Warble Fly." *Advisory Leaflet.* Univ. Coll. North Wales, Jan., 1930.

WEEDS OF GRASS LAND

H. C. LONG, B.Sc. (Edin.),
Ministry of Agriculture and Fisheries.

ANY means that will enable the farmer to reduce the weed herbage in his grass land will, within reasonable limits as to cost, tend to increase his profits, (1) because the grazing is improved, and (2) because well-got hay from weed-free grass land containing plenty of young clover is richer, more digestible and more relished by stock. The reduction of weeds in grass land is intimately associated with the best means of grassland improvement.

Weeds in arable land are more readily observed than those in grass, but it is doubtful whether they are so easily reduced. Arable land may have the advantage that it provides periods when it is free of crops, but it must be recollected that when winter corn is taken it occupies the land for about ten months and so gives certain weeds every opportunity to be fruitful and multiply—to re-establish themselves. If grass land is really taken seriously in hand, and properly treated and managed, there is every expectation that rapid improvement will result, including severe reduction of the weed species. With continued good management the improvement should be permanent.

What the Improvement of Grass Land Involves.—In spite of the increased attention paid to grassland farming in recent years there is still a vast area of permanent grass which could readily be greatly improved. It is probably no exaggeration to suggest that at least one-half of our permanent grass (total for England and Wales 15,489,921 acres*) could be made to double its present annual output within ten years, while quite a useful proportion of mountain and heath land used for grazing (total for England and Wales 5,282,884 acres*) could be sufficiently improved to bring about a marked increase in its feeding value. The immense benefit which would naturally accrue in the course of such improvement would include a reduction in the weed flora. Indeed, any means that will really tend to the "improvement" of grass land automatically reduces weeds and the less valuable grasses.

Grass land is commonly termed meadow or pasture according as it is chiefly devoted to haymaking or grazing, although meadow land will be grazed after haying, while in some

* Agricultural Returns, 1929.

districts the fields are alternately grazed and reserved for hay. In general, too, any grass land which has existed as such for many years comes under the term *permanent pasture*.

Some of the best grazing land in the Midland counties is depreciated in value by the presence of excessive quantities of weeds, especially the Creeping Thistle, and it is held by some of the local farmers that the eradication of these weeds would lead to an increase of anything up to 20s. per acre in the annual value. Second rate and poor pasture can similarly be greatly improved, not only by reducing weeds but by increasing the yield and quality of the grasses and leguminous species—the improvement of the grasses being commonly the consequence of an increase in the leguminosæ.

It may be suggested that the loss due to the presence of weeds on grass land and the labour in cutting them is at least equal to 7s. 6d. per acre per annum on all the grass land in the country; and individual farmers may view their grass land with this figure in mind.

There may be differences of opinion as regards the figure quoted, but there can at least be no doubt that all farmers in every county are deeply interested in weed control, and it is clearly to their individual and joint benefit that they should combine forces and combat these insidious foes.

It may be held that reduction of weeds gives more space and more valuable herbage; rather would it be more accurate and desirable to observe that an improvement or stimulus of the grasses and clovers (especially wild white clover) means less space for and consequently an automatic reduction of weeds. The most important point to bear in mind, therefore, is the need for a general grading up of the herbage by all practicable and economical means. This is quite as important to agriculture as the grading up of stock, for if stock are the basis of successful farming it is clearly none the less true that good food and plenty of it is the basis of successful feeding. The improvement of grass land generally is of greater moment than an assault upon individual weed species—though these will rightly receive special attention to further the improvement.

The improvement of grass land involves a change for the better in the soil texture or sole, freer drainage, disappearance of "mat," a swing over from poor to good grasses, gradual reduction of weeds, frequently an increase in wild white clover, sweeter and richer herbage, earlier bite in the spring and later bite in the autumn, a steady grading up in fertility, and increased production of meat, milk and wool.

It is not intended here, nor is it desirable, to enlarge upon this side of the subject; a very useful account of grassland improvement is given in Bulletin No. 3.¹ It will suffice to emphasize the point that if weeds in grass land are to be reduced satisfactorily the principles to be followed must be such as make for a general improvement in the herbage. Soil and climate are both involved, and hence also drainage and manuring. Thoroughness of grazing is of much importance, as also are the encouragement of leguminous plants and the direct destruction of individual species of weeds. The general treatment of grass land—its “management”—must depend upon the soil itself, and upon local conditions. No definite rule can be laid down, and, subject to what may be said hereafter as to the various methods which make for improvement, each farmer must decide his own procedure.

The Worst Weeds of Grass Land.—It is by no means an easy matter to define specifically which are the worst weeds of grass land, because the species that are most troublesome in one district and on one soil are not necessarily the same as those that are worst in another district or on a different soil.

The composition of the herbage of any grass land varies to a considerable extent, according as to whether it be meadow, pasture, or hill grazing, and also according to locality, variation in soil, and aspect. Changes in the herbage also arise in consequence of good or bad management, and the mere grazing with one or other of the various classes of live stock may effect considerable alterations in the character of the herbage.

Numerous investigations have been made, at various times, into the botanical composition of the herbage of permanent grass land, and it has been demonstrated that many of Britain's best pastures contain a considerable proportion of so-called weeds.

As long ago as 1888 an investigation by Fream² showed that the species of plants found growing in old pastures are not very numerous. The plants to which he refers number 31 grasses (some of them, such as *Holcus lanatus*, being commonly regarded as weeds, though they may be highly useful in some situations), 8 leguminous plants, and 18 miscellaneous species of weeds not grasses or clovers. In a sub-

¹ Bull. No. 3 (*The Improvement of Grass Land*), 8d. post free from the Ministry.

² *Jour. R.A.S.E.*, 1888, pp. 415-447.

sequent paper³ he only found it necessary to mention 21 grasses, 5 leguminous plants, and 22 miscellaneous species or weeds. In the complete investigation, which involved the examination of 80 turves taken from pastures in 28 English counties, 6 Welsh counties, 8 Scotch counties and 11 Irish counties, the following weed species were found in the 80 turves :—

Bent Grasses (<i>Agrostis</i> spp.)	.. .. .	76 times.
Yorkshire Fog (<i>Holcus lanatus</i>)	.. .. .	63 ..
Buttercups (<i>Ranunculus</i> spp.)	.. .. .	66 ..
Narrow-leaved Mouse-ear Chickweed (<i>Cerastium</i> <i>triviale</i>)	.. .. .	49 ..
Common Sorrel, or Sour Dock (<i>Rumex acetosa</i>)	.. .. .	32 ..
Ribgrass, Ribwort, or Plantain (<i>Plantago</i> <i>lanceolata</i>)	.. .. .	25 ..
Hawkbits (<i>Leontodon</i> spp.)	.. .. .	19 ..
Self-heal (<i>Prunella vulgaris</i>)	.. .. .	14 ..
Daisy (<i>Bellis perennis</i>)	.. .. .	11 ..
Yarrow (<i>Achillea millefolium</i>)	.. .. .	10 ..

Excluding Yarrow, Yorkshire Fog, and even Bent, which in certain circumstances are useful plants, the remaining species include the really significant weeds present in the pastures, others being in very small quantities and not of such agricultural interest. Many other weeds, however, were found more than once. The complete list of “miscellaneous” species mentioned, comprising “weeds” apart from grasses and leguminous plants, is as follows, in alphabetical order :—

<i>Achillea millefolium</i> L.	..	Yarrow or Milfoil.
<i>Bellis perennis</i> L.	..	Daisy.
<i>Bunium flexuosum</i> With.	..	Earth-nut.
<i>Cardamine pratensis</i> L.	..	Cuckoo Flower.
<i>Carduus</i> spp.	..	Thistles.
<i>Carex</i> spp.	..	Sedge.
<i>Cerastium triviale</i> Link.	..	Mouse-ear Chickweed.
<i>Leontodon autumnalis</i> L.	..	Autumnal Hawkbit.
<i>Leontodon hispidus</i> L.	..	Rough Hawkbit.
<i>Luzula campestris</i> L.	..	Field Woodrush.
<i>Plantago lanceolata</i> L.	..	Ribgrass, Ribwort, or Plantain.
<i>Potentilla anserina</i> L.	..	Silver-weed or Goose Tongue.
<i>Prunella vulgaris</i> L.	..	Self-heal.
<i>Ranunculus acris</i> L.	..	Upright Buttercup.
<i>Ranunculus bulbosus</i> L.	..	Bulbous Crowfoot or Buttercup.
<i>Ranunculus repens</i> L.	..	Creeping Crowfoot or Buttercup.
<i>Rhinanthus crista-galli</i> L.	..	Yellow Rattle.
<i>Rumex acetosa</i> L.	..	Common Sorrel or Sour Dock.
<i>Rumex crispus</i> L.	..	Curled Dock.
<i>Sonchus</i> spp.	..	Sow Thistle.
<i>Taraxacum officinale</i> Web.	..	Dandelion.
<i>Veronica chamaedrys</i> L.	..	Germander Speedwell.

³ *Jour. R.A.S.E.*, 1890, pp. 359-392.

The extent to which some of the weeds occurred in the pastures was also ascertained ; it was found that 13 out of the 80 turves were composed to the extent of 50 per cent. and upwards of "weeds," the highest figure being 89 per cent., and the average of the 13 no less than 65 per cent. On the other hand, 28 contained only from 0 to 5 per cent. of "miscellaneous" or weed herbage, while the remainder (39) contained from 5 to 49 per cent. It must, however, be noted that the turves were growing under somewhat unnatural conditions, and the weeds often tended to become exaggerated, especially in the case of *Rumex acetosa*. In one case, 89 per cent. of the herbage consisted of weeds, but Fream remarked, "This turf showed early signs of an abundant growth of *Achillea millefolium*, and at length it became smothered with this plant to an extent which would never be possible in continuously grazed land." In several cases, upwards of 70 per cent. of the miscellaneous herbage was *Rumex acetosa*.

Yet we find it stated that 5 acres of a pasture in North Staffordshire, from which the turf examined consisted of 67 per cent. "miscellaneous" herbage, the balance being 32 per cent. grasses and 1 per cent. leguminous, would "fatten four shorthorn barreners between the middle of May and the beginning or middle of August in a fairly good season ; they will afterwards fatten, say, a dozen or fifteen wether sheep." It is clear that in well-grazed pastures the bulky "miscellaneous" herbage is kept down, and "under the normal treading and grazing of stock, such species as *Achillea millefolium*, *Leontodon* sp., *Rumex acetosa*, would never make the display which characterized several of the turves."

It seems likely that these well-grazed pastures were particularly rich in virtue of their being kept short, and that the weed herbage, being young and leafy, was perhaps nearly as good as the grass itself. Work in this direction is being done by Stapledon at the Welsh Plant Breeding Station at Aberystwyth, and it may conceivably prove true that certain weed species may be regarded as valuable fodder so long as they are kept grazed so close that they remain young and leafy.

In 1890, in a report of some observations and experiments on some English pastures,⁴ Carruthers (then Consulting Botanist to the Royal Agricultural Society) referred to the examination of some of the pastures from which Fream's

⁴ *Jour. R.A.S.E.*, 1890, p. 95.

turves were cut, and although he did not come to the same general conclusions as Fream, he found that weeds constituted in some cases a large proportion of the herbage. For example, a Dorset pasture carried 22 per cent. of Ribgrass (*Plantago lanceolata*), 9 per cent. of Bugle (*Ajuga reptans*), 8 per cent. of Buttercup (*Ranunculus acris*), 4 per cent. of Yarrow (*Achillea millefolium*), and 3 per cent. of Knapweed (*Centaurea nigra*). In another case, a Somerset pasture carried 63 per cent. of Ribgrass and 8 per cent. of other weeds. Carruthers concluded that of the fourteen pastures he visited, not one "is so good as it might easily be made. The extraordinary abundance of such objectionable grasses as Yorkshire Fog and Meadow Barley-grass in some of the pastures is surprising." He further observed that, "A plant of Nature's sowing on his (the farmer's) farm, where it should not be, is a weed to be eradicated. . . . In laying down land to pasture, as in sowing fields with wheat or any other crop, we must try to surpass Nature. We must bring together the most nutritious perennial plants which will supply palatable food for stock as far as possible all the year round, and we must exclude the weeds and worthless grasses which we have found too abundant in natural pastures."

In 1907 Armstrong reported upon an investigation into the composition of the herbage of several types of pasture and meadow land, especially fine old pastures in the Market Harborough district of Leicester and Northampton. His conclusions⁵ are of considerable interest, among them being :—

- (1) That white clover and ryegrass form by far the greater part of the herbage of the best grazing lands—both old and recent in the English Midlands—and that the next most abundant species on these pastures are usually crested dogstail, bent (*A. stolonifera*), and rough-stalked meadow grass.
 - (2) That the herbage of the inferior types of grass land in the same districts consists very largely of bent grass (*A. vulgaris*) and various weeds, while white clover and ryegrass are present in comparatively small quantities.
 - (3) That the only other species of grasses which are occasionally abundant in these pastures are cocksfoot and sheep's fescue in the better fields, Yorkshire fog and tufted hair-grass in the poorer ones.
 - (4) That the herbage of a pasture varies botanically to a considerable extent during a season, this variation being, however, determined very largely by soil, situation, and weather.
- * * * * *
- (9) That the quantity of herbage available per acre for grazing depends much upon the density of the herbage, and that no

⁵ *Jour. Agric. Sci.*, December, 1907.

plants appear to be more capable of producing a dense growth of herbage than white clover and ryegrass, providing the soil is suitable for them.

- (10) That the number of individual plants per acre on the best old pastures, and necessary for the production of a thick, close turf, is probably very much less than is usually supposed.

In the course of an inquiry some twenty years ago in which 29 practical agriculturists were asked by the writer to state what they considered to be the six worst weeds of grass land in their neighbourhood, an analysis of the replies showed that the following species were considered to be the worst weeds in the stated number of instances :—

Thistles	22
Buttercups	16
<i>Holcus lanatus</i> and <i>H. mollis</i>	9
Docks	8
Daisy	7
Plantain	6
Soft Brome	6
Yellow Rattle, Sorrels, Dandelion, <i>Agrostis</i> spp. each	5
Knapweed, Rushes, Nettles each	4
Ragwort, Hassock Grass, Rest Harrow each	3
Moss, Self-heal, Sedges, Hawkweed (<i>Hieracium</i>), Bracken, Mountain Flax, Scabious, Meadow Saffron.. .. . each	2
Sweet Vernal, Rough-stalked Meadow-grass, Mouse- ear Chickweed, Couch, Ox-eye Daisy, Pig-nut (<i>Conopodium</i>), Cow Parsley (<i>Petroselinum</i>), Meadow Barley-grass, Cat's-ear, Corn Marigold, Stinking Mayweed, Wild Carrot, Cowslip, Broom, Gorse, Dyer's Green-weed, Silver-weed each	1

It is deserving of note that a considerable number of these species are not mentioned more than once or twice, some are often held to be useful, while one or two of them at least (Corn Marigold, Stinking Mayweed) are mainly weeds of arable land. Many such weeds, however, may prove very serious pests, and the fact that they are mentioned as among the six worst weeds of any given district is sufficient to show that where they grow an endeavour should be made to reduce them.

Extensive grassland trials conducted in 1927 led to a statement⁶ as to the distribution and development of weeds on the various areas of grass land concerned; and it is observed that some opinion can be formed of the weed distribution in the centres from the following list of percentage frequencies :—

⁶The *Intensive Treatment of Grass Land*, The Rt. Hon. Lord Bledisloe, K.B.E., 1928.

Species	Percentage frequency
Thistles (<i>Carduus</i> spp.)	63
Sorrels (<i>Rumex acetosa</i> , <i>R. acetosella</i>)	50
Creeping Crowfoot (<i>Ranunculus repens</i>)	50
Rib Grass (<i>Plantago lanceolata</i>)	41
Daisy (<i>Bellis perennis</i>)	41
Docks (<i>Rumex</i> spp.)	34
Stinging Nettle (<i>Urtica dioica</i>)	28
Bitter Buttercup (<i>Ranunculus acris</i>)	25
Hawkbits (<i>Crepis</i> spp., <i>Hieracium</i> spp.)	22
Woodrush (<i>Carex</i> spp.)	19
Yarrow (<i>Achillea millefolium</i>)	19
Hoary Plantain (<i>Plantago media</i>)	19

The fact that the first three of these species occurred at half or more of the centres is significant. It deserves to be recognized, however, that species which may be highly injurious weeds on poor, neglected and run-out pastures and meadows, may prove to be of little importance on fertile and closely cropped grass land. Indeed, in some situations species commonly regarded as bad weeds are likely to be considered in quite another light—as useful in providing acceptable green fodder where clovers and good grasses are far from plentiful. It might perhaps be suggested that, taking the country as a whole, and allowing for differences due to soil and situation—which may change the outlook somewhat—the following species, jotted down almost haphazard, may be regarded as the worst grassland weeds :—

Bracken	Rushes	Heather and Heaths
Thistles	Sedges	Daisy
Buttercups	Rest Harrow	Woodrush
Sorrels	Dyer's Green-weed	Yarrow
Docks	Nottles	Cow Parsleys
Ragwort	Mosses	Yorkshire Fog
Ox-eye Daisy	Hawkweeds	Creeping Soft-grass
Knapweed	Silver-weed	Soft Brome
Dandelion	Self Heal	Hassock Grass
Yellow Rattle	Gorse	Mat-grass
Horsetails	Broom	<i>Brachypodium</i> spp.

* * * * *

LEONARD MEAGER AND THE "MYSTERY OF HUSBANDRY," 1697

G. E. FUSSELL,

Ministry of Agriculture and Fisheries.

WE know very little of the life of this writer : like so many other early writers on farming and gardening, almost all we can learn of him must be gathered from his books. We do know, however, that he was for some time a gardener to Sir Philip Hollman, at Warkworth, in Northamptonshire, and by so much must admit his claim to be considered a practical man as opposed to the many theorists who wrote farming books in the heart of the metropolis.

The motive which actuated him was, according to his Preface, to supply what had been omitted by other writers, who had, in his opinion, "come short of what was, no doubt, well meant, because most of them had not practised what they had writ, but were obliged to borrow them from others and to take them on Trust, and many of them from Foreign Authors; not well considering that different Climates produce different Effects though things are managed one and the same way . . .

"These things, I say, consider'd, I have grounded this work upon long Experience, and truly proved to my great Advantage, whatever I have laid down."

This was, as Donald McDonald says,¹ sound logic, and is indeed the foundation, upon which, with some amplification, modern agricultural science and practice has been built. McDonald adds rightly that Meager seems to have carried these advanced ideas right through his book in a manner which commands respect for the man and his methods.

To this encomium the remarks of an earlier writer are an apt addendum.² "Though no notice is made of animals," he says, "Meager's book must be reckoned a very considerable advance in the progress of agriculture. The matter is better arranged than by the previous authors, and the subjects are sooner related and more quickly dismissed. The title page is still loaded with the contents of the work, and the prefaces are lengthy and the dedication clumsy. Still a large progress has been made."

The modernity of some of Meager's views is exemplified by his comparison of the advantages derived by the State from the activities of the merchant and the farmer, except that the

¹ *Agricultural Writers, 1200-1800*. 1908, p. 148.

² John Donaldson : *Agricultural Biography*, 1854.

verbal expression of his opinions is not in the modern fashion of brevity, and appeals to Divine Authority for its confirmation.

"The Excellency of Husbandry," he says, "appeareth partly by its Antiquity, as we esteem Things to be more Admirable, the more Ancient, the nearer they come to God, the First Being of all Beings . . . The Merchant is a gallant Servant to the Common-wealth, he fetcheth its Riches from far, and he is a worthy Contributor to the Wealth and Prosperity of the Kingdom; but he produceth it from others. But this Merchant of Husbandry, he raiseth it out of the Earth, which otherwise would yield little, unless his Ingenuity digged and fetched it out. What rates purchased he it at? Even only by his own ingenuous Industry and with the Wages of his Labouring Man, whom he is bound both by the Laws of God and Nature to allow a Competent Maintenance."

A large portion of the first part of the book which he hopes will be so useful to these estimable members of society is devoted to the preparation of the soil for crops, because, as Meager says, "In Ploughing and Ordering, and right preparing of the Ground for Seed, consists the chiefest Point of Husbandry," and the crops must be suited to the soil in which they are planted and to the disposition of the Heavens over that soil. In this connexion he sets out the order of merit of the different animal and bird manures, and commends the lupin as a green manure "before he bear his Cod." The making of compost is described. Straw and fern, etc., should be laid in a ditch to rot "with the filth of sinks and privies, but in the midst you must lay some sound Substance, against the breeding of Adders and Snakes . . ." The intermixture of superstition with sound practice is further demonstrated by the advice to lay most dung at the top of sloping fields so that it may be washed down, coupled with that to do manuring when "the Wind is Westerley and the Moon on the Wayne." We now know, of course, that the moon has no influence on crop growth although it seems still necessary to say so.³

Marl, lime, chalk and clay as dressings for different types of soil form a constant subject for the agricultural writers of the time, and Meager does not hesitate to say that the Germans use the first of these successfully, which seems to intimate that some, at least, of his protestations of deriving the whole of his teachings from his own experience are ill-founded.

³ C. F. Marvin: *Calendar in History and Success of Farming*, U.S. Year-book of Agriculture, 1928, p. 177.

When he goes on to the improvement of barren ground we find that he owes a large debt to his predecessors in his chosen field of literature, practically the whole of Chapters IX to XIII being transcribed, sometimes verbally, and sometimes in paraphrase, from *Markham's Farewell to Husbandry* (1620), while his exordium on the value of pigeon's dung for heavy wheat land is derived from Gabriel Platte's *Discoverie of Infinite Treasure* (1639). The details of the methods recommended for the reclamation of waste and heath and its use for alternate husbandry are not, however, without interest.

He expresses a more personal opinion in the controversy as to the use of oxen or horses as plough animals. "Where Horses may be used, they are more commodious for the Plough, and the fewer of them the better; for many Horses draw too hastily, and make too large Furrows, which is not good." Here again he garners wisdom from a continental practice, stating that they only use two horses to a plough in the neighbourhood of Cologne and do very good ploughing, but he also refers to a light plough used with light horses in Norfolk. This was evidently the type so much praised by Arthur Young a hundred years later. Sometimes a harrow was fastened behind this light plough and used with it, and this practice is said to have been in good esteem in the county. Breaking up immediately behind the plough, often a good practice, is apt to be regarded as something new. Meager's implement was probably very narrow and light.

The most necessary ploughs to be used in England are of four main sorts: (1) the single wheel and foot plough; (2) the wheel plough called the double wheel plough; (3) the simple plain plough without wheels or foot; and (4) the Dutch bastard, or plain Dutch plough. Meager gives instructions for building these types; all kinds of ploughs are, however, useful in some sort of land or other. A frontispiece to the book shows these types of implements, and, as Donaldson has observed, "The portraits of the implements are the exact delineations given by Blyth in his book of *English Improver Improved*, which fact, with the same descriptions given by Meager, show that no improvement had taken place in respect of ploughs during the half century that elapsed betwixt the dates of the publication." In spite of all that has been written about the vast progress made during the eighteenth century Lord John Somerville made much the same remark a hundred years after Meager! In his book he suggests he will "save those who search after improvement much trouble and confusion, by

giving a copy, or facsimile, of ploughs then in use, taken from a treatise written by Walter Blith, about the year 1653, by which, at once, we perceive how little originality of invention or improvement has been manifested in the greater part of the swing and wheel ploughs constructed within the last hundred and fifty years. Two or three exceptions there are, which shall be immediately noticed."⁴

The ploughs of which Meager speaks were, of course, made of wood and fitted with an iron share preferably "well steel'd," a coulter and sometimes a plate of iron fastened to the mouldboard to take the wear. Bearing this in mind, as well as the fact that the ploughs were made locally, we can appreciate some of Meager's remarks. The plough, he says, should be rather made to be suited to the irons, than the irons to the plough, because in the second case it will be in a manner worn out before it works easily. Again, the plough maker who makes according to a rule he has only learned by trade, not knowing how to hold a plough, if he makes a true plough, must rather hit it by guess than infallibility. The evils of using a plough not suited to the soil in which it is working are listed, "the Cattle may be spoiled, the Men toiled, and the Plough spoiled, and yourself disappointed in the well ploughing of the Ground." Many good ploughs, however, are spoiled in the using, and for this reason, the ploughman ought to be a judge of ploughwright's work; he should not try out a new plough on rough land. A very modern note is struck by the axiom, "the irons wear bright and clean, it is a proper sign of workmanship on his (the wright's) part."

Draining was another subject that occupied a good part of the attention of writers of this time. Meager does not perhaps pay so much attention to this subject as some others. He suggests that moors should be drained by gutters, and that "Reeds of Fetches, Pease straw or that of Lupins" should be ploughed in for their manurial value; and describes a single coulter trenching plough to cut one side of a trench at a time, called the Trenching Plough, as well as a Trenching Spade which from the illustration may also be derived from Blith. The land drained will, he says, bear excellent wheat, rye or barley, if treated in accordance with the precepts he has laid down for barren land.

Naturally also, we find instructions for growing what were then known as artificial grasses, because the seventeenth century

⁴ *Facts and Observations Relative to Sheep, Wool, Ploughs and Oxen*, 1809, p. 129.

was the period of their introduction into English farming. "Claver" is good for land exhausted by corn "that it will bear it no longer," and the home-produced seed is as good as that imported from Holland. A gallon, or 12 lb., should be sown per acre, and the seed should be mixed with earth to ensure good distribution in broadcasting. It may be grazed from October to January, and its feeding will return a profit of £12, as it will grow on land worth 20s. an acre and last good for five years with a little manure.

St. Foin (sainfoin) or French grass is good for seven years and then as green manure for corn. Lucerne grows well on dry, barren land, but is not very common, "nor has any considerable improvement been made of it in this Kingdom; however, it may be proper for barren lands of little value for anything else."

Turnips will provide "Winter-stores for yourself, plenty for your Cattle, and the like for the market, if you live near any good Towns; this being a very wholesom, moist, cooling and nourishing Root, good against Feavers, and all hot Diseases, allaying the acrimony of the Blood." Carrots and parsnips also receive praise, but it is a little surprising to find praise of potatoes, which did not come into general use as an article of human diet until many years later, the first book on the tuber having only been published about 30 years before Meager's own production.⁵ Meager did not, like so many others, doubt their usefulness as human food. He says: "Another good thing that may make good improvement, though not in such a general manner, are Potatoes; these being once in the Ground will spread extreamly . . . they are very nourishing and wholesom to the Stomach, and a little piece of ordinary Ground will produce a sufficiency for the use of many Families a whole Winter, and many succeeding Winters, their encrease being very great . . ."

Flax and hemp are also, according to Meager, improving crops and he favours hops and the dye plants, such as madder, weld and woad, and saffron. In connexion with his remarks on these plants he gives us some idea of the districts in which they were cultivated. Saffron, for instance, grew abundantly when cultivated in Suffolk, Essex and Cambridge, and the best natural parts for woad were some districts in Worcester, Warwick, Oxford, Northants, Gloucester, Leicester, and Bucks, and some other places, a sufficiently wide area. Such informa-

⁵ John Forster: *England's Happiness Increased*, 1664.

tion is of great historical interest and similar details are included in some general advice.

“ . . . in stiff Clays, of which all the fruitful Valleys of this Kingdom are composed, as also in *Huntingdonshire*, *Cambridge-shire* and *Bedford-shire*, and many others, all manner of Arable business must be begun early in the Year, and the Ploughs, and Instruments to be used, made of the longest size, the Timber strong, and the Labour great and painful ; so also in Soils that are mixed, and very good and fruitful, as *Hertfordshire*, *Northampton-shire*, and most part of *Berkshire*, *Essex* and *Kent*, with other Counties of the like nature, Arable Labour ought to begin in the latter Season, and the Instruments and Ploughs, made of a middle size, and the Timber indifferent, and less labour will serve than in the former : but the light Sandy Grounds, having a natural fruitfulness in them, as *Surrey*, *Suffolk*, *Norfolk*, and many parts of *Lincoln-shire*, *Hampshire*, etc., the Arable Toils may begin at the last Seasons, and Ploughs, with Instruments, may be of the smallest and lightest size, and Timber smaller than the former, and the Labour less.

“As for all barren unfruitful Earth, as in *Cornwall*, *Devonshire*, many parts of *Wales*, *York-shire*, *Cheshire*, *Lancashire* and *Derby-shire*, and the like, the ploughing and ordering is to be at a fit Season, according to the temperatures of the weather, which if it happen early, you must begin your Labour at latter Seasons.”

In an approval of inclosure, made many years before the intensive enclosure by Parliamentary process of the eighteenth century, he says : “ Where the Grounds are inclosed, how happily people live ; as in *Hertfordshire*, *Essex*, *Kent*, *Berkshire*, *Surrey*, *Wiltshire*, *Somerset-shire*, *Hampshire* and others, all which not only raise Corn for themselves, but supply other open Counties, and even the great City of *London*, which consumes a vast quantity thereof ; and yet no parts of England set a greater rate, or make a greater advantage by Grazing.”

The book also contains information about timber trees, and a commendation of the practice, common in Hereford, Worcester and Gloucester, of planting fruit trees in the hedge rows. It concludes with a Countryman's Almanack, which, however, only contains weather signs and some superstitions such as the unfortunate and fatal days of the year, and the Nativity of our Lord falling on any day of the week thereby showing the disposition of the Year.

Meager also published two books on gardening, one in 1670

and the other in 1697. The first of these was dedicated to his employer and deals with Fruit trees, the Kitchen Garden and the Garden of Pleasure, including various lists of plant names. The book published in 1697 has an interesting introduction which ends with the pious hope: "May the Bookseller have so much profit in the selling it, and thou the same Pleasure and Profit in buying it, that has accrued to me by Collecting, and Experience therein;" . . . The matter is set out differently from that in the earlier publication and the book contains chapters on cider- and perry-making, etc.

BIBLIOGRAPHY

(1) *The English Gardener; or, A Sure Guide to young Planters and Gardeners*. In three Parts: by Leonard Meager, above thirty years a Practitioner in the Art of Gardening. Large 8vo, pp. 252. Illustrated with copper engravings at end. (1670.)

(2) *The New Art of Gardening with the Gardener's Almanack: containing the True Art of Gardening in all its Particulars*: by Leonard Meager. 12mo, pp. 164; one plate. (1670.)

(3) *The Mystery of Husbandry; or, Arable, Pasture and Woodland Improved. . . . To which is added the Countryman's Almanack*: by Leonard Meager. 12mo, pp. 161; illustrated. (1697.)

TWO EXPERIMENTS ON TAPIOCA MEAL AS FOOD FOR PIGS

G. WYLLIE HOWIE, B.Sc.,

Agricultural Organizer for the Isle of Man.

IN the issue of this JOURNAL for May, 1929, an account was given of an experiment, conducted at the Harper Adams Agricultural College, with tapioca meal or root flour, comparing it with maize meal as a source of digestible carbohydrates in the ration of the fattening pig. As comparatively little barley is grown in the Isle of Man (oats forms practically the sole cereal crop), and pig feeders are dependent very largely upon imported supplies of barley meal, maize meal and millers' offals, except in cases where dairy products and potatoes are available, it was decided that the possibilities of tapioca-root flour as a cheap source of carbohydrates were worthy of serious consideration, and it was resolved to make a comparative trial of maize meal and tapioca root flour at the Experimental Farm of the Board of Agriculture for the Isle of Man. At the time the article referred to was published tapioca-root flour was several pounds per ton cheaper than both barley meal and maize meal. The extra freight on goods to the Island provided a further inducement to explore any avenue likely to lead to the reduction of feeding costs.

FIRST EXPERIMENT

Live Stock.—Twenty-three pigs were available. They were bred on the farm and were the progeny of one Large White and two Middle White sows. All three litters were sired by the same boar, a pure Large White. The pigs were weighed when four weeks old and again at nine weeks. Sixteen pigs that showed the most uniform rates of growth between the first and second weighings were selected for the experiment. They were divided into two lots, as evenly as possible with regard to sex, litter and weight. Each lot contained two gilts, and the boars of the litters were castrated at five weeks old. The live weights of the tapioca group ranged from 32 to 43 lb., while the maize meal group ranged from 30 to 41 lb. The average live weight of both groups was 36½ lb. The experiment began on July 30, 1930, and finished when the pigs were 29 weeks old on December 17. The pigs were weighed at weekly intervals throughout this period. At all times, weighing was done first thing in the morning before feeding, and, at the conclusion of the experiment, the final weights were taken as being the average of three weighings on the last three consecutive mornings.

Rations.—The scheme of rationing was based on the recommendations contained in the Ministry's Miscellaneous Publications No. 48, "Pig-keeping." A basal ration of sharps, barley meal and fish meal was common to both groups. At a later stage, palm kernel cake meal was added to the basal feed. Lot No. 1 received tapioca-root flour in addition to the basal ration, while Lot No. 2 had a similar proportion of maize meal.

On July 30, the composition of the rations was :—

	<i>Lot No. 1</i>	<i>Lot No. 2</i>
	per cent.	per cent.
Sharps	60	60
Barley meal ..	20	20
Fish meal ..	10	10
Tapioca-root flour	10	—
Maize meal ..	—	10

When the pigs were twelve weeks old, the proportion of tapioca-root flour and maize meal was increased to 20 per cent. and later, at the 20th week of age, to 25 per cent., at which it remained to the end of the experiment. Palm kernel cake meal was introduced into the basal ration when the pigs were 12 weeks old, and was fed at the rate of 20 per cent. of the total ration up to the last five weeks, when it was replaced by crushed oats. The fish meal was diminished progressively after the pigs were 20 weeks old and was cut

out entirely from the feeding during the last five weeks. All changes in the rations were made gradually. The final ration was :—

	<i>Lot No. 1</i> per cent.	<i>Lot No. 2</i> per cent.
Sharps	20	20
Barley meal ..	35	35
Crushed oats ..	20	20
Tapioca root flour	25	—
Maize meal ..	—	25

General Management.—Throughout the period of the experiment, the animals were housed in loose boxes, with abundant light and ventilation. Both groups fed satisfactorily from the beginning. The mixtures were fed dry, and the method followed was to allow the pigs as much as they would clean up in a given time. Feeding was done three times per day in the initial stages of the experiment, but was subsequently reduced to twice only. The pigs had water always before them.

The health of both lots was excellent. The pigs in Group No. 1 developed a slight skin eruption during the third week of the experiment, but after the administration of a dose of salts the trouble disappeared.

With regard to palatability, there was nothing to indicate that maize meal was superior to tapioca-root flour, nor did the tapioca-root flour have any adverse effect upon the functioning of the digestive organs.

A week before the experiment ended, one of the pigs in Lot No. 2 had some sort of fit. It recovered satisfactorily, but it was considered advisable to have it killed and it was accordingly sent to the butcher.

Results.—The experiment ended on December 17, and the pigs were sent to the butcher that day. They were killed on the 18th, having been fasted since after the evening meal on the 16th. Table I gives the relevant information as to live weights, food consumed, etc. :—

TABLE I

	<i>Lot No. 1</i> <i>Tapioca</i> 8	<i>Lot No. 2</i> <i>Maize</i> 8
No. of Pigs		
Total gain in live weight	1,528.3 lb.	1,517.1 lb.
Average „ „ „	191.04 lb.	189.64 lb.
Total dead weight	1,375.25 lb.	1,387.50 lb.
Average „ „	171.91 lb.	173.44 lb.
Carcass percentage	75.63 per cent.	76.78 per cent.
Total food consumed	6,800 lb.	6,750 lb.
Food per lb. l. wt. increase	4.45 lb.	4.45 lb.
Total cost of food	£32 : 9 : 6½	£34 : 4 : 11½

	<i>Lot No. 1</i> <i>Tapioca</i>	<i>Lot No. 2</i> <i>Maize</i>
Cost of food per lb.	1.15d.	1.22d.
Cost of food per lb. l.w.i.	5.09d.	5.52d.
Average l.w.i. per pig per day	1.36 lb.	1.35 lb.

The gains in live weight ranged in Lot No. 1 from 156 lb. to 206 lb.; and in Lot No. 2 from 159 lb. to 226 lb. The dressing percentages showed ranges from 74.23 to 77.09 in Lot No. 1, and from 72.06 to 78.46 in Lot No. 2.

Through the courtesy of the Isle of Man Butchers' Association, reports were furnished on the carcasses of the two lots. The unanimous finding of the three members of the Association who killed the pigs was that there was nothing to differentiate those fed on the tapioca ration from those fed on the maize meal ration.

The pigs were sold on the basis of their dead weight, at the current rate of 10½d. per lb. It is the practice in the Isle of Man to exclude the weight of the head when buying pigs on a dead-weight basis, but the dressing percentages shown above are for the complete carcass. At the beginning of the experiment, the pigs were valued by two independent valuers, and the financial aspect of the feeding is shown in Table II.

TABLE II

	<i>Lot No. 1</i> <i>Tapioca</i>	<i>Lot No. 2</i> <i>Maize</i>
Valuation at July 30	£14: 8: 0	£15: 0: 0
Cost of food consumed	32: 9: 6½	34: 4: 11½
Gross return at 10½d. lb. dead weight	55: 9: 6	55: 11: 2½
Net return	8: 11: 11½	6: 6: 3½
Net return per pig	1: 1: 6	0: 15: 9½

No charge has been made for rent, rates, taxes or labour, but on the other hand nothing has been deducted for the manurial values of the different feeding stuffs.

Discussion of Results.—The average rate of live weight increase was satisfactory with both the tapioca and the maize groups. There is a very slight difference in favour of Lot No. 1, but certainly not sufficient to warrant any assumption that tapioca-root flour is superior to maize meal in a ration for fattening pigs. Again, there is but little difference in the amount of food required in each case to produce one pound of live weight increase. A slightly lower average gain in live weight in the case of the maize meal lot is compensated for by an improved dressing percentage in the carcass. * The outstanding feature of the experiment was the reduction in costs effected by the use of tapioca-root flour in place of maize meal. The cost of the food per lb. is 0.07d. lower in the case

of the tapioca ration, but the cost of producing one pound of live weight increase is practically $\frac{1}{2}$ d. less than with maize meal. The tapioca pigs showed a higher profit for feeding than the maize lot, by almost 5s. 9d. per pig.

SECOND EXPERIMENT

With the idea of noting the extent to which the results indicated during the early stages of the first experiment could be considered reliable, a second trial was started on September 20, 1929.

Livestock.—Thirteen pigs, eight weeks old, were available. Seven were the progeny of a Large White sow and six were out of a Large White gilt. The sire of both lots was the same Large White boar as in the case of the pigs used in the first experiment. They were divided into two lots, as before. The first group, which was given the tapioca ration, contained six pigs, while there were seven in Group No. 2, the maize meal lot. The average weight of the pigs in Lot No. 1 was 23·8 lb., and, in Lot No. 2, 23 lb.

Rations.—The scheme of feeding was the same as for the first experiment, except that, when the pigs were 12 weeks old, 10 per cent. of crushed oats was introduced and continued to the end of the feeding period; palm kernel cake meal was not fed at all. The final ration was :—

	<i>Lot No. 1</i> per cent.	<i>Lot No. 2</i> per cent.
Sharps	30	30
Barley meal	35	35
Crushed oats	10	10
Tapioca root flour	25	—
Maize meal	—	25

General Management.—The housing and method of rationing were the same as in the first experiment.

Pig No. 13 in Lot No. 1 developed a rupture towards the end of October, and had to be removed from the experiment.

Results.—The experiment ended on February 11, 1930. The pigs were weighed before the morning feed on the last three days, and the averages of these were taken to be the final weights. On this occasion, the pigs were sold live by public auction, with the exception of two, one from each lot, which, as formerly, were sold on a dead-weight basis. Table III shows the various results obtained.

TABLE III

	<i>Lot No. 1</i> <i>Tapioca</i>	<i>Lot No. 2</i> <i>Maize</i>
No. of Pigs	5	7
Total gain in live weight	910.0 lb.	1195.0 lb.
Average gain in live weight	182.0 lb.	170.7 lb.
Total food consumed	3,919.0 lb.	4,800.0 lb.
Food per lb. of live weight increase	4.3 lb.	4.02 lb.
Total cost of food	£18 : 7 : 5½	£24 : 0 : 6
Cost of food per lb.	1.13d.	1.20d.
Cost of food per lb. of l.w.i.	4.85d.	4.83d.
Average l.w.i. per pig per day	1.27 lb.	1.19 lb.

Discussion of Results.—These results agree with those obtained in the first experiment in at least two particulars : (1) with maize at £12 5s. per ton, and tapioca-root flour at £9 5s., the substitution of the latter for the former cheapened the cost of food per lb. by 0.07d. ; (2) the average rate of live weight increase with tapioca was very similar to that with maize. Actually, in the second trial, it was slightly better, but the difference was too small for any significance to be attached to it.

The tapioca pigs made a larger gain in live weight per pig by some 12 lb., but on the other hand they consumed rather more food per lb. of live weight increase than those fed on maize meal.

The pigs in this second experiment did not thrive as well as those in the first trial, but there was nothing to indicate that the tapioca-root flour had an adverse effect on either the rate of growth or on the health of the animals.

Conclusions.—From the foregoing experiments it is permissible to infer :—

(1) That high-grade tapioca-root flour has proved satisfactory as far as its palatability and its effect on the digestive organs are concerned.

(2) That, in a ration for fattening pigs, it may replace maize meal up to at least 25 per cent. of the total ration.

(3) That the quality of the carcass is not affected adversely by the feeding of tapioca-root flour to the extent indicated.

COUNCIL OF AGRICULTURE FOR ENGLAND

THE Thirty-Fourth Meeting of the Council was held at the Middlesex Guildhall, Westminster, on Friday, October 31, *Mr. Denton Woodhead* being in the Chair. The Chairman offered the Council's congratulations to Sir George Edwards on the honour of Knighthood which had been conferred upon him since the last meeting of the Council (May 30, 1930). *Sir George Edwards* replied with a short speech of thanks. The Chairman then welcomed Dr. Addison, M.P., on his first appearance at the Council as Minister of Agriculture; also Lord De La Warr on his appointment as Parliamentary Secretary. He added that he was glad that the Minister had been able to insert legislation dealing with the scrub bull in the list of items of the Government's agricultural policy. The subject was one which the Council had taken up strongly and on several occasions had impressed upon previous Ministers.

The Minister thanked the Chairman, saying he was assured that the Council concerned itself with constructive criticism rather than with the other kind, and that it was determined to deal with agriculture in a non-party spirit. He hoped to make a beginning in introducing the Government's proposals in a few days' time. There was a likelihood of three main Bills. The Scrub Bull Bill would be introduced into the House of Lords almost at once. He thought that the measure was essential to the welfare of British live stock. As to the other measures, he asked members to do all they could to assist the Government. There was nothing in the Land Settlement Bill of which anyone need be afraid. The Marketing Bill was on the agenda with various other items for to-day's meeting.

Agricultural Marketing Bill.—*Sir Arthur Hazlerigg, Bart.* (Leicester), Chairman of the Standing Committee, moved the adoption of the Committee's Report on the Agricultural Marketing Bill.* First of all, he wished to tender the Committee's best thanks for the painstaking way in which officials of the Ministry had explained the Bill to the Committee and answered all its questions. There was divergence of political views amongst members both on the Council and on the Standing Committee, but he thought that the Committee had managed, notwithstanding, to produce a unanimous Report. Broadly speaking, it supported the Bill. Under the Bill, the

* See Appendix, page 901.

individual farmer would not be in danger even if he were subjected to compulsion. The Standing Committee had found that farmers needed more organization in marketing, and this the Bill proposed to give in a way which, while compelling a reluctant minority, would be fair to the industry. The Committee had had before them representatives of certain Dominion Governments, and also the benefit of discussing with them the lines of the new marketing proposals. In this connexion, there was one word of warning he wished to utter. It was dangerous to argue that because a scheme had been a success or failure in some other part of the globe that it must be a success or failure in this country. The main factors were often entirely different.

The condition which the Committee attached to their recommendation of the Bill was that some control of imports was necessary from countries where costs of production were lower than in this country, or where subsidies or veiled subsidies were paid. Such competition was unfair, and agriculture should be guarded against it. As to the kind of protective measures, that was a matter which the Committee left to the Government.

The Rt. Hon. Sir Francis Acland, Bart., said he wondered whether any free trader who voted for this Report could properly count as a free trader any longer. He was one, and while admitting that, as a member of the Standing Committee, the Committee had given most cordial consideration to his suggestions, there were certain words at the end of paragraph 4 to which he could not possibly agree. These words were "where the costs of production are lower than in this country." If these words were retained, the Report would mean that steps would have to be taken to deal with wheat coming from India or from the Argentine; with many things coming from any European country or from Ireland; and with wheat from Canada, where the cost of production was less than in this country. The principle would apply also to timber. He could not agree that the importation of timber should be licensed, or home supplies protected. If we could not compete in our own markets with ordinary supplies from Belgium, Denmark, Argentina, India, Canada and Ireland, he would rather give up agriculture altogether than have the industry supported at the general public expense. He thought the Government could and should deal with "dumping" in its strictly proper sense. If the Report went further and raised expectations of considerable State help by means of

general protection, the Marketing Bill would fail because farmers would not trouble to work it.

Mr. Chas. Roberts (Cumb) said he would like to support Sir Francis Acland on the plea that the Council should discuss the Marketing Bill for itself, and not slide away into what are called its "necessary complements." The Bill was a very important measure with new features in legislation, and it would not be very easy to get it through. Adding further burdens to it, would not help. The merits of the Bill were very real; firstly, the Government gave a power which might lead farmers away from their engrained traditions of individualism, and, secondly, the Bill did give a chance of the producer getting more of the final price of his goods for himself. The "necessary complements" to these advantages were in the Bill itself, namely, the power of dealing with surpluses. At the present time, the National Farmers' Union stated the price of milk, and the retailer fixed it. Under the Bill, the surplus would be taken off the market and manufactured by a producers' board, and a better price for the bulk of the commodity would be secured. His enthusiasm for Protection was damped by the recollection that general elections were bound to come along, and with six urban electors to one rural elector there seemed very little chance of an abiding state for that policy.

Mr. J. Hamilton (Lancs) suggested an alteration in the Report to meet Sir Francis Acland's difficulty.

Mr. John Beard said that "the costs of production" was an unsafe and unsatisfactory phrase, and he suggested that the word "wages" be inserted instead. He was neither a free trader nor a tariff reformer, and had not learned to subscribe to the cry of cheap food, knowing that it had to come out of the bones of men who were not getting wages enough to pay for their ordinary daily sustenance. What would be the reply if the country were told that cheap boots or cheap clothes were essential; what would the Trade Unions say? He objected to the same talk about cheap food.

Mr. R. G. Patterson, O.B.E. (Staffs), reminded the Council of the cause of all recent marketing measures, namely, the enormous difference between the price paid to the producer and that received from the consumer. The Marketing Bill aimed at a solution in favour of the over-pressed producer without imposing hardship on the consumer. At the same time, there would be extraordinary difficulties in the way of carrying the measure into effect. He thought the Government must have

realized in presenting the Bill that some control of imports was necessary. The Government might say, "If you, the agricultural community, are prepared to do your best to welcome the Marketing Bill, we, on our side, are prepared to introduce legislation to make it possible for you to work this Bill." At the moment, the community had no assurance that this was the Government's view. He then asked one or two questions as to detail, *e.g.*, how district boards would work as between one another with such a commodity as milk. He foresaw that an enormous staff would be required to regulate the supplies of milk which each individual must produce, or to keep records of that milk. The Bill would take some considerable time before it was of any great advantage to the agriculturist, and, in view of the dire state of agriculture, he wondered what would happen to them in the meantime.

Sir Arthur Hazlerigg intervened to say that as Chairman of the Standing Committee he was prepared to accept the substitution of "wages" in the place of "costs of production."

Mr. W. B. Taylor (Norfolk) congratulated the Standing Committee on its excellent Report and did not agree that the debate should be confined to the Bill itself. The debate was on the Standing Committee's Report, and the Committee would no doubt welcome any constructive criticism upon it. He was glad to hear *Sir Arthur Hazlerigg's* decision. He viewed with considerable surprise the statement of *Sir Francis Acland* that the policy recommended by the Standing Committee would mean that agriculturists were asking to be permanently supported at the public expense. Anyone studying the history of agriculture in this country would readily agree that the countryside had been bled white to the benefit of the urban population, and that the public had really lived at the expense of the countryman on the principle of the dole. Only the countryman had had to take less than the dole, whilst others got away with the middlemen profits and had benefited in other ways where they toiled not neither did they spin, but the schemer scored and the worker lost every time. He was sorry to have to speak so bluntly, but he came from a county where the farmers were disgusted with political matters and were setting up what was called the "Norfolk Movement" to solve their difficulties. This Council was a classless organization representing the whole industry. He welcomed the alteration in the Report as one made in the right spirit of the Council.

Mr. H. W. Thomas (Hants) said that as a farmer of over 40 years' experience he thought the Marketing Bill, unless accompanied by some control of imports, would be of little use to agriculture. The same view was held by the National Farmers' Union. Another point was that the Bill threatened gross restriction on personal liberty. Farmers were restricted at present, having to pay a fixed wage and fixed tithe, and if the Bill established methods of sale without improving prices, more harm than good would be done by it to the industry.

The Minister of Agriculture thanked the Council for the discussion. The Bill was perhaps a difficult one to follow, as wording was always at the dictates of the lawyers. In the case of milk, which had been mentioned, the price paid to the farmer was not kept down by importations. The chief feature in its marketing at the present time was the almost complete disorganization of the producers and the existence at the same time of an undealt-with surplus. The position did not relate in any way to the age-long controversy of protection or free trade. Processing and dealing with surpluses of all kinds of agricultural produce would be more fully dealt with in the Bill in its next revised form. As regards the farmers' boards, there were two types referred to in the Bill, namely, that which would actually deal with the commodity physically, holding it and marketing it, and that which would act as a sort of regulating pool only. The two types were necessary because of the diversity of the products in agriculture. As to milk, again, that commodity would be one for the regulating type of board, and he hoped that the large distributing combines would be willing to come to working arrangements with a national milk-producers' board in the business of disposing of the product. The Bill made provision for the exemption of what might be called the "local supplier." It would be quite absurd to produce a scheme whereby a farmer could not readily supply his neighbours in the village with milk. The producer-retailer might also be a reasonable exception, and there might be others. As an example of a district board, there were commodities like Cheshire cheese.

The Bill was designed to enable producers to combine for better marketing, but it did not give a guaranteed market ; that was an impossibility except with complete socialization of supplies ; and prices could not be governed until there was an organization of producers competent to handle their products in a comprehensive way, to collect, grade, and

distribute, and to promote the formation of processing plants or factories. It was only possible to help the farming community to help itself in the face of the extremely powerful middle agents. He believed that the real distributors would welcome the provision of commodities in a more organized and disciplined way, and he thought it was only possible to attain that by means of the Bill.

As regards compulsion, in Yorkshire only recently the following was the case with a bacon factory with 1,500 members which was designed to operate upon 1,000 pigs a week. When prices were good the pigs were there, but when they had fallen the farmers were tempted away to sell their animals privately instead of to the factory, and now only about 400 pigs a week were forthcoming. He thought it would be to the good of all the farmers if there were pressure behind those who backed away from their moral obligation to support the factory.

The Minister added that both he and his colleague, Lord De La Warr, were extraordinarily cheered by the critical examination which the Council had given to the Bill, and its commendation of it. An amended form of the Bill would shortly be forthcoming, and any further suggestions from the Council would be welcome.

The Chairman then put it to the meeting that the Report be adopted, the word "wages" being substituted in place of "costs of production" in paragraph 4. The alteration was agreed and the Report adopted.

Insecticides and Fungicides.—*Mr. Cecil Robinson (Holland, Lincs)* moved the following resolution on behalf of the Standing Committee :—

That this Council considers that legislation should be passed as soon as possible to provide that insecticides and fungicides sold for agricultural purposes be made subject to similar regulations to those imposed in the case of sheep dips under the Sheep Scab Order, or of fertilizers and feeding stuffs under the Fertilizers and Feeding Stuffs Act of 1926; *i.e.*, it should be made possible to compel sellers of insecticides and fungicides to give a declaration that they reach the necessary effective strength.

The motion was seconded by *Mr. J. T. Briggs (Soke of Peterborough)*. *Mr. Robinson* said that thousands of pounds were spent every year in fungicides in his county for spraying potatoes and celery. The market price of the chief one was about £30 a ton, and it should be up to a certain strength. A mixture at £25 a ton was being offered which, when analysed, was found

to be very inferior. He thought that many farmers and small-holders were paying double the price they should for their fungicides. *Sir Douglas Newton, K.B.E., M.P. (Cambs.)*, agreed and said he thought that the legislation would not be very controversial. He understood that the proposal had the support of Gloucestershire and Herefordshire, and would probably receive that of other county agricultural authorities if brought to their attention. Dry spraying was not always successful, though it could be if two conditions were observed. First, it must be properly carried out, and, secondly, the proper material must be used. *Mr. Briggs* pointed out that regulations would be useful, as in the case where a farmer wanted credit. It might not always then be easy for him to get a sample analysed before he bought. *Sir Merrik Burrell, Bart., C.B.E. (West Sussex)*, said that it might be possible for the Ministry to draw up a schedule of approved insecticides and fungicides on the same lines as they had drawn up a list of Sheep Scab dips.

Earl De La Warr, replying on behalf of the Ministry, said that the Department was anxious to encourage the wide use of spraying operations against insect and fungus pests. A Bill would be required for the purpose of the resolution, and it would not be entirely non-controversial; there might, therefore, not be any parliamentary time available. The Report of a Committee appointed to consider the Bill of 1921 had just been published. If those interested in the subject would consult with the Ministry, it might be possible to make the existing Bill non-controversial, and the Ministry would then be very glad to go forward with the matter.

The Resolution was put to the Meeting and carried.

Agricultural Policy.—*Mr. W. W. Sampson (Dorset)* moved :

That this Council, recognizing the ruinous condition of the agricultural industry, respectfully advises His Majesty's Government immediately to confer with the Leaders of the Opposition, with a view to agreeing to a policy for the relief of the present distress, and further each and every member of this Council pledges themselves severally and collectively to assist the Government in carrying such a policy into effect, regardless of party politics.

Mr. J. Hamilton seconded. *Mr. Sampson* drew attention to the fact that since the repeal of the Corn Production Act there had been a decrease of nearly two million acres under the plough, and of 130,000 agricultural workers; in addition, it had been stated that there were at the present moment a very large number of agricultural workers unemployed. He

had said at the last meeting that the industry was in a ruinous state; such figures as these proved his statement. He acknowledged that the sugar-beet subsidy had been a great help. Advice was the other thing that was given, and that seemed to him to have led to over-production in certain directions, *e.g.*, milk. The Minister had said that milk was not affected by imports. What then was the significance of the condensed milk importation, the equivalent in raw milk of the 1929 importation being 81½ million gallons? The resolution was purely a matter of procedure. He had been careful not to introduce any question of policy. He realized that he was now addressing members of the three political parties, and also members of the agricultural workers and land-owners' organizations. He realized that all of them could deal with agriculture without any political or party feeling. There had to be willingness on both sides, and he therefore suggested his resolution as leading the way to agreement so that the industry might be saved from disaster.

Major F. H. Fawkes (West Riding) pointed out that the fact that condensed milk the equivalent of 81½ million gallons was coming into the country was a strong argument in favour of the adoption of the Marketing Bill. The example of Sweden, Denmark and Holland showed that where by-products could be dealt with efficiently and despatched abroad it was a great advantage to the dairy industry. He suggested that these by-products should, in the case of this country, be manufactured into condensed milk here and save the need of imports.

Sir G. L. Courthope, K.B.E., M.P. (East Sussex), said he hoped that the Council would not be so foolish as to pass the resolution proposed. The Council should not saddle itself with such a resolution, the trouble being not party politics but rival sub-divisions of the industry seeking for their own profit. Rural interests were largely outnumbered by urban interests; and in the rural industry there was nothing approaching agreement. If that industry could be united in a statement of its wants, that would be a big advance. It should also be remembered that agriculture was not the only industry that was depressed and stood in need of assistance.

Mr. Patterson stressed the fact that agriculture was the foundation of all other industries, and that though others may be suffering it seemed essential for the national benefit to place agriculture on a sound and profitable basis. This also would be in agreement with the recent pronouncements

of all Parties. Wages were fixed and he knew at the moment of 12 men whose services on a farm were being dispensed with. His own dilemma was whether to give up farming altogether, or to turn his farm largely down into grass. The coal industry appeared to be entitled to a living wage at the expense of the taxpayer—surely agriculture was also entitled to it. He had spoken as regards the Marketing Bill, but he now wished to say something about the new proposals for small-holdings. He did not think that these could be increased unless by subsidies. The small-holder to-day was living on subsidies.

The Minister informed the Council that before the Recess an attempt was made to bring the different Parties together in consultation in this matter, but that no progress was made. He need not now go into the reasons, but the proposal did not commend itself to them. After all, some subjects were so complex and so big that the principles of different sides did not lead them to formulate a united policy. He was glad to feel that there was as much co-operation at present as seemed to be possible.

The resolution was put to the meeting and carried by 25 votes to 22.

Protection from "Dumped" Produce.—*Mr. H. T. Cox (Herts)* moved—

That faced with the gravest crisis known to any living agriculturist, and with a full sense of its responsibility and position, this Council does most urgently call upon the Government, in the interests of the agricultural community and of the whole nation, to take immediate and active steps to prevent further dumping of Russian and foreign bounty-fed wheat and other food products, which is even now resulting in more and more farm workers being forced out of employment, numbers of small-holders failing, farmers and land owners rapidly being forced into bankruptcy, and land lying derelict.

Mr. S. Wallace (Herts) seconded the Resolution. *Mr. Cox* said, as regards the Russian wheat importation, that some little time ago he had been asked to collect for the Red Cross Societies in this country for a fund for starving Russians. Either that was wrong then or the Russian Government was wrong now by taking wheat for export from these starving Russian peasants. He left it to the Council to form its own opinion. In agriculture, there should be as high a standard of living as in any other industry. In the industry to-day it was difficult to make the money to pay out the wages on Friday night. Then, again, in ordinary industry, workers could be dispensed with in bad times, but it was quite a different thing considering the close personal

relations between most farmers and their men. The co-operative societies were the first people to deal in Russian wheat, though they were started in order to help the working man. Was there good sense in helping the working man of Russia by starving the working man of this country? The Government's scheme for settlement, small-holdings, etc., was at odds with the policy which allowed men who really knew the job to be driven off the land. It would be better to give half the proposed money to keep the present people in farming. If wheat-growing could be made profitable, all other branches of agriculture would fall into line. *Mr. A. E. Bryant (Bucks)* said that farmers were losing their best men; the old men were staying on, but the young men were not content with 30s. or 31s. a week. It was a very serious matter to delay bringing prosperity to agriculture. He himself employed 25 men, and wanted to see the time come when he could pay these highly skilled workers £3 a week. He did not see the use of the Council meeting to discuss matters, while this sort of thing was allowed to continue. *Mr. G. G. Rea, C.B.E. (Northumberland)*, suggested that the resolution should be amended by the substitution of the word "cereals" for the word "wheat." The mover and seconder of the resolution agreed. *Mr. W. Holmes* drew attention to a memorandum of the East Sussex Farmers' Union on the question of imports of cereals and food-stuffs. Out of 225 farmers in that Union, 12 only sold more cereals than they bought. The majority were glad to buy food-stuffs cheap in order to turn them into pig and other products. As regards oats, he was speaking a few weeks ago in a Gloucestershire village where the farmers sold their own oats to the racehorse proprietor and bought German oats for their own stock. The racehorse owners were now following suit, and it seemed to him in everybody's interest to buy the cheapest they possibly could. As regards "dumping," he was not in favour of it, but after all someone in this country must be buying Russian cereals for them to be "dumped." He suggested it was in many cases farmers themselves.

The resolution was then put to the meeting, the word "cereals" being substituted for "wheat." The resolution was adopted.

Prosecutions under the Fertilizers and Feeding Stuffs Act, 1926.—*Mr. A. E. Bryant (Bucks)* moved—

That in order to secure an effective and economical administration of the Fertilizers and Feeding Stuffs Act, 1926, the Minister of Agriculture and Fisheries be urged to take steps to

amend the Act in order to restore to local authorities power to institute criminal proceedings in respect of adulterated samples taken on the premises of the purchaser; on the ground that the present Act is not economical in administration and affords the minimum amount of protection to the farmer.

It was duly seconded. *Mr. Bryant* said that, as a result of the recommendations of the Departmental Committee on the Fertilizers and Feeding Stuffs Acts, amending legislation was passed which altered the method of taking proceedings. It was submitted that the change of procedure in the case of samples taken by inspectors of local authorities on the premises of the purchaser, by which such samples cannot be made the subject of criminal proceedings if found adulterated, did not tend to increase the efficiency of the new Act. These principles might be ideal if everyone, trader or manufacturer, were honest, but experience in Bucks had shown that such was not always the case. To prosecute successfully under the new Act, it was necessary that the sample should be taken on the premises from goods prepared, or consignments ready, or exposed for sale. In the case of the purchasers being under another local authority, one inspector had to pass information on to another, and by the time the latter arrived at the factory to take his sample on the premises he failed to find anything that would not satisfy the Act, or there was no such article prepared for sale. *Sir Charles Howell Thomas, K.C.B.*, speaking on behalf of the Ministry, reminded the Council that the Act of 1926 was produced as a result of careful consideration by the Committee presided over by Lord Clinton, and that this question of proceedings was specially considered by that Committee and the Act framed according to their finding. He suggested that it would be best to have a further trial before the step now contemplated was taken, as the matter was by no means as simple as might appear. The resolution was put to the meeting, and 12 voted for it and 12 against. The Resolution was not carried.

APPENDIX

REPORT FROM THE STANDING COMMITTEE OF THE COUNCIL OF AGRICULTURE

AGRICULTURAL MARKETING BILL

(1) The Committee has, over a period of three years, given special attention to the question of the improvement of agricultural marketing in this country. It has issued twelve Reports on the marketing of specific commodities, nearly all of which have been printed and circulated throughout the counties.

(2) It appears to the Committee that the Bill is a logical development of policy in sequence with the provisions of the Agricultural Produce (Grading and Marking) Act of 1928. It is known to those

who have studied the marketing situation in this country and in certain of our Dominions that a measure of compulsion on outstanding minorities of producers has been deemed necessary in several instances where producers endeavouring to sell co-operatively or to take joint action to regulate marketing on up-to-date lines have been frustrated or discouraged by the action of a small number of individualist sellers. Moreover, it is the fact, where a commodity is to be sold in a free market and there is a prospect of growers over-stocking the market and upsetting a fair price, that no one seriously doubts the advisability of producers combining for the purpose of orderly marketing, on some such lines as those indicated in the Bill. The selling pool or other organization to be effective should, in fairness, embrace all producers of the commodity to be marketed. The Bill does not, however, impose anything on producers, except on the initiative of groups substantially representative of those who produce the product to be dealt with in the area to which a scheme applies. The measure, therefore, is entirely optional on groups of farmers and the legislation may be said to provide means, which farmers may adopt or not as they choose, to help them to market their produce efficiently. There is nothing in the Bill to prevent commodities being dealt with in national rather than local schemes, and arrangements would no doubt be made for correlation of effort among local boards dealing with the same product.

(3) Instancing three commodities—milk, potatoes and hops—in which the country may be said to be largely self-sufficing, it is the case that in each of these in recent years there has been serious trouble through the home production being uncontrolled and in excess of direct consumption. There has been a lack of central organization to indicate what quantities can safely be supplied for the home market, to decide what price should be asked for the produce available for sale having regard to the costs of production and the demand for it, and, in the case of milk and potatoes, to deal with surpluses and to undertake much-needed publicity on an adequate scale. The provisions of the Bill would be most useful in such cases.

(4) If the Bill would be useful in instances where competition from abroad is not very pronounced, the need for it is probably even stronger with regard to those commodities in which there is overseas competition, and in which the supplies coming on to the home market may easily be extended beyond the bounds of any possible bumper home crop. But in the case of these commodities—with the addition, possibly, of potatoes in certain exceptional years—there is, it is suggested, a need for more than internal organization on the lines of the Bill, for no amount of combination for marketing or compulsion of minorities will avail where the home market is under-sold by imports of agricultural produce from countries where [costs of production*] are lower than in this country, or where subsidies, or veiled subsidies, are paid.

(5) For this reason, the Committee considers that the measure can only reach its full beneficial effect if there is coupled with it control of such imports under a scheme which will ensure that these do not undersell a fair home market. The Committee is not concerned with the methods of control, which may be by tariffs, or licences, or even State purchase of those commodities which are being "dumped" at less than their cost of production in the country of origin, or by a combination of any of these. There may be grave objections to any and all possible methods, but the present marketing position is so serious that a way should be found immediately to prevent the continual underselling of our home agricultural market by imports coming

* See reference at end of Report.

under the heads named. Certain branches of agriculture already threaten to become entirely bankrupt on account of this evil. In the case of cereals, in which the marketing position is by far the most serious, it is the fact that by the establishment of a quota system by which all millers would be required to buy a percentage of home-grown wheat in flours for bread-making, some amelioration would be secured. But a moderate quota, which it might be reasonable to impose, could hardly be effective in helping arable agriculture to pay if large quantities of overseas wheat, subsidized or deliberately marketed below cost, were allowed to be landed in this country. Even in the case of the articles in which there is a virtual monopoly, *e.g.*, milk, potatoes, and hops, the present system of non-control of food imports under any possible set of circumstances may at any time through improvement and cheapening of transport and/or cold storage permit of entry of below-cost imports which will swamp these fortuitously protected markets.

(6) If, therefore, the Bill is likely to become law at an early date, the Committee most earnestly represent that its necessary complement is a measure of imports control of the kind suggested. At the same time, we agree that the Marketing Bill can be made of considerable value to farmers in helping them to organize the marketing of those commodities in which they are not driven out of business, and that certainly the state of things it aims at establishing is an undoubted improvement on the present almost entirely unorganized condition.

(7) For the information of members of the Council, a short summary of the contents of the Bill is appended :—

Summary of Draft Bill

(8) The explanatory Memorandum printed with the Bill shows that the Bill proposes to allow producers of an agricultural product to which it applies (milk, potatoes, hops, wool, cereals, cheese, live stock) to regulate the marketing of that product by means of boards elected by themselves and in accordance with schemes submitted by themselves. Such regulation is to be confined to products grown in the area to which the scheme is applicable, which may be Great Britain or any part thereof, and the scheme will be binding on all producers of the regulated product in that area.

(9) The interests of the public and of individual producers are protected by requiring the Minister, before approving a scheme, to give notice of it and to consider any representations made, and by giving Parliament the opportunity of resolving that the scheme shall not come into force.

The interests of producers are further protected by provisions for independent arbitration and either for exemption from the scheme or for representation on the board administering it.

The interests of the general public are further protected by the establishment of a special "Consumers' Committee" for every scheme, whose duty it will be to watch, and consider complaints as to, the effect of the scheme on consumers. The Bill also establishes a "Committee of Investigation" to which the Minister may refer a complaint from a Consumers' Committee or a complaint which would not fall to be considered by a Consumers' Committee. If the Committee of Investigation report that any matter requires rectification, the Minister has power to amend or revoke the scheme, and, if necessary, to replace the board administering it by persons nominated by him. The Minister is also empowered on his own initiative to lay before Parliament the draft of an Order revoking or amending a scheme, such Order to come into force unless Parliament resolves to the contrary.

A scheme may also provide for the encouragement of agricultural research and education and may empower a board to make money advances to producers.

(10) To take the Clauses of the Bill in order :—

Clause 1 makes provisions for the submission and approval of schemes by persons who are substantially representative of those who produce the product to be dealt with in the area to which the scheme is applicable. This clause works in conjunction with the First Schedule to the Bill which prescribes rules for the submission, approval, amendment and revocation of schemes.

Clause 2 deals with the constitution of boards of representatives of registered producers which shall administer the schemes.

Clause 3 sets forth what matters a board may deal with, subject to the approval of the Minister. They may be allowed :—

- (a) to buy, sell, grade, pack, store, adapt for sale, insure, advertise or transport the regulated product, to manufacture any article from that product and to sell any article so manufactured ;
- (b) registered producers may be required to sell the regulated product or any kind, variety or grade thereof, only to, or through the agency of, the board ;
- (c) to regulate sales of the regulated product by any registered producer by determining :—
 - (i) the kind, variety or grade of the product which may be sold ;
 - (ii) the quantity of the product or of any kind, variety or grade thereof which may be sold ;
 - (iii) the price at, below or above which, and the terms on which, the product or any kind, variety, grade or quantity thereof may be sold ;
 - (iv) the persons to, or through the agency of whom the product or any kind, variety, grade or quantity thereof may be sold ;
- (d) to regulate the manner in which the regulated product is to be graded, packed, stored, adapted for sale, insured, advertised or transported by or on behalf of registered producers ;
- (e) to provide for certain incidental or consequential matters, and to enable the board to encourage agricultural education and research.

Clause 4 states what miscellaneous provisions every scheme shall provide :—

- (a) for requiring that no sale of the regulated product shall be made by any producer who is not either a registered producer or a person exempted from registration by or under the provisions of the scheme ;
- (b) for exempting from all or any of the provisions of the scheme producers of such classes or descriptions as may be specified ;
- (c) for requiring the board to recover from any of the producers who contravene the scheme such monetary penalties as may be specified ;
- (d) for securing that any producer who is aggrieved by any act or omission of the board may refer the matter to arbitration ;
- (e) for keeping and furnishing accounts, and for requiring estimates, returns, accounts and other information to be furnished by registered producers, and providing powers of entry and inspection, as set out in the Third Schedule of the Bill.

Clause 5 requires that every scheme shall provide for the establishment of a fund to be administered and controlled by the board, and gives the board certain powers of assessing and recovering contributions,

and for borrowing. Any scheme may also empower the board to lend any registered producer sums proportionate to his interest in the scheme. The board may issue a debenture to create in favour of a bank a floating charge on any farming stock which is vested in it, and the charge shall be registered in the same way as agricultural charges under Part II of the Agricultural Credits Act, 1928, are registered.

Clause 6 allows of the continuance of existing contracts in certain circumstances and for their proper registration.

Clause 7 provides for the appointment of consumers' committees, and a committee of investigation.

Clause 8 requires the Minister to lay an annual report before Parliament.

Clauses 9-12 relate to the provision of agricultural marketing funds. For the purpose of financing boards, £500,000 shall be paid out of moneys provided by Parliament into an English fund, and £125,000 into a Scottish fund. Out of these funds a short-term loan may be made to a board when it is first set up free of interest for two years, but must be repaid within that period unless renewed. A long-term loan may be made to a board at any time for any period, but the amount of the fund that may be immobilized in such loans is limited. Loans may only be made on the recommendation of a special committee appointed under the Bill.

Clause 13 provides that any expenses incurred by the Minister in connexion with any committee appointed under the Bill shall be defrayed out of moneys provided by Parliament. (The explanatory Memorandum states that the aggregate expenses incurred under this provision and of any additional staff which may be required by the Bill are not expected to exceed £20,000 per annum.)

Clause 14 sets out the procedure in connexion with the laying of draft Orders before Parliament, and the publication of Orders in the Gazette.

Clause 15 makes the Bill applicable to the articles named in the Fourth Schedule, viz., milk, potatoes, hops, wool, cereals, cheese, live stock.

Clause 16 is an interpretation clause.

Clause 17 sets out the modifications in applying the measure to Scotland.

Clause 18 states that the Bill shall not apply to Northern Ireland.
October 22, 1930.

[Adopted by the Council at its meeting on October 31, 1930, the word "wages" being substituted in the last sentence of paragraph four (page 902) in place of the words "costs of production."]

MARKETING NOTES

A Review of the National Mark Fruit Schemes.—The application of the National Mark Scheme to fruits has now reached the third year. In view of the comprehensive and far-reaching nature of the reform undertaken, the scheme has developed far more rapidly and has met with greater support from all sections of the trade than was anticipated. Many enthusiasts, lacking knowledge of the difficulties besetting reform in the intricate processes of fruit marketing, expected the whole trade to be placed on a fully-efficient basis at once. Experience has shown them, however, that reform is a comparatively slow process which calls for faith and perseverance, together with a liberal measure of friendly co-operation between all interests concerned.

Growers.—Many growers, in the first flush of enthusiasm, expected that the application of the National Mark to their packages would bring an immediate increase of monetary return. Experience has now convinced these growers that, while the scheme secures for them the full value of their fruit, it is in the general increase in efficiency of the fruit industry, particularly in the sphere of marketing, that the major benefit lies, and that the more rapid the growth of the scheme the sooner will this benefit be received.

The value of the scheme in providing a national basis for advertising home-grown fruits is now widely realized, and this is an important factor in securing and maintaining the support of all sections of the trade.

Probably the most important effect of the scheme, so far, is the incentive which it has given to growers to strive for better quality in production. The establishment of clearly defined statutory standards of quality has revealed to many growers their failings in production methods. In the absence of standards based on the requirements of the distributive section of the trade, each grower worked to a standard which he considered to fit the circumstances, but which was often lamentably low. The National Mark Scheme has provided a real basis upon which these growers can establish their production and marketing operations, irrespective of whether they use the Mark or not. Indeed, since the inception of the National Mark Fruit Scheme, there has been an enormous improvement in the standard of production, grading and packing set by growers who are not yet using the Mark. Many state frankly that they are grading and packing to National Mark standards although not yet participating in the scheme.

Some of these growers still cling to the idea that the value of their private mark or label is paramount and think that this is lost when they join in the scheme. They fail to realize that the influence of their private brand is limited to a comparatively small circle of buyers and that expansion of this circle is slow and difficult. They cannot understand that the National Mark not only certifies the private mark but extends its usefulness.

Salesmen.—At the outset, the Ministry's staff available for propaganda work was very limited and, in consequence, the efforts of marketing officers were directed mainly towards producers and retailers. It was assumed that if growers marketed under the Mark and retailers responded with a demand for National Mark fruit, the salesmen handling it would do so efficiently whatever might be their opinions of the scheme. This assumption proved to be correct, and important salesmen have become supporters of the scheme. Recently, a more intensive propaganda among wholesale distributors has been undertaken. Funds have been provided for advertising the scheme in the fruit trade papers, and by means of a leaflet to be circulated to salesmen as well as to growers and retailers. In the advertisement and leaflet, the aims of the scheme are set forth briefly, followed by the opinions of leading growers and salesmen, together with the collective views of retailers given by their Federation and Associations. Some opinions were given in the first advertisements and in a leaflet distributed at the Imperial Fruit Show.

Retailers.—The propaganda in the retail section of the trade was intensive at the outset and has resulted in the unanimous support of the organized retailers. Many retailers expected to be able to buy full-weight National Mark graded fruit at the prices hitherto paid for short-weight ungraded lots. They bought, nevertheless, and their experience showed that National Mark packs were worth more. In the larger markets, at least, they are now prepared to pay the real value, and in the smaller markets the extension of supplies and experience will speedily bring about the same result.

Retailers have co-operated whole-heartedly with the Ministry in advertising the scheme by displaying posters.

Supplies.—In the case of all fruits in the scheme, the demand in the markets has far exceeded the supplies, but the position may be expected to improve when the propaganda referred to above has made its influence felt.

Contraventions.—In the beginning, the view was expressed

that, because of the voluntary nature of the scheme, growers electing to pack under it would endeavour to maintain the standards laid down. The small number of contraventions reported—14 in all—shows that this confidence in the goodwill and integrity of the growers was justified. In every case, the contravention was due to temporary failure in the supervision of grading and packing operatives. In all cases but two, it has been sufficient to draw the growers' attention to the cause to secure satisfactory grading. So far, there has been no suspicion of growers deliberately using the Mark as a cloak for off-grade fruit.

Supervision of Grading and Packing Operatives.—The great importance of maintaining strict supervision of grading and packing is not adequately realized by growers. Every opportunity has been taken to impress upon those authorized to apply the Mark the need for vigilance in this connexion and they have been advised to open and examine the contents of a small proportion of packages ready for dispatch from time to time. If this is done, slackness on the part of the grading and packing operatives is prevented.

National Mark Eggs.—One of the conditions governing the National Mark Egg Scheme requires that packers shall have a certain minimum weekly output. During the months of January to July, this minimum is 900 dozen eggs per week, and this is reduced, in view of seasonal decline in production, to 600 dozen per week for August and September, and 300 dozen per week for October, November and December. An encouraging feature of the returns of sales which have been rendered by packers during September—the last month for which complete figures are available—is that at a large number of stations there is little or no falling off from the quantities recorded for July, and that the total output of all stations has fallen to a slight extent only as compared with the reduction in the output qualification. This is largely due to producers increasing their laying stock.

During the 10 months, January-October, 1930, the output of the authorized packing stations amounted to 194 million eggs, of which 138 million were packed under National Mark labels.

Several important firms of egg merchants have recently taken active interest in the scheme and, in some instances, have made application for authorization.

National Mark eggs commanded very high prices during October, with beneficial effects on the English egg market

generally, but, following large imports of Dominion eggs, prices weakened somewhat, and it is now considered that this year's peak period for prices has passed.

As mentioned in the November issue of this JOURNAL (p. 813), three classes in the Egg Competition at the Dairy Show, held in October at the Royal Agricultural Hall, London, were open only to packers of National Mark eggs. The event proved a popular innovation, and was well supported by National Mark egg packers in all parts of the country. Eggs entered for each of the three classes had to be graded and packed in accordance with the requirements of the scheme. The first class was for 30-dozen, non-returnable wooden cases, containing eggs of "Standard" weight grade; the second was also for eggs of "Standard" weight grade but in 15-dozen, non-returnable fibreboard cases; and the third was for 15-dozen fibreboard containers with eggs of "Special" weight grade, packed in half-dozen or dozen cartons. A very high standard of quality was attained by competitors in each of these classes and judging was not an easy task. Silver and bronze medals were awarded in each class, the prize-winners being:—

- First Class. (1) Wiltshire Egg Producers, Ltd., Hungerford.
(2) Gloucestershire Marketing Society, Ltd., Cheltenham.
- Second Class. (1) Welwyn Garden City Poultry Farm, Ltd. Welwyn.
(2) E. J. Parker, Maidstone.
- Third Class. (1) Vye & Son, Ramsgate.
(2) Captain F. Barber, Morecambe.

National Mark Beef.—The weekly average number of sides (including quarters and pieces expressed in terms of sides) of beef graded and marked with the National Mark during October, and the number of sides graded and marked for the four weeks ended November 22, was as follows:—

LONDON				<i>Number of sides</i>
Weekly average—	October	..	..	1,925
Week ended	—November 1	..	..	2,005
" "	— " 8	..	..	2,159
" "	— " 15	..	..	2,155
" "	— " 22	..	..	2,065
BIRKENHEAD				
Weekly average—	October	..	..	729
Week ended	—November 1	..	..	879
" "	— " 8	..	..	1,084
" "	— " 15	..	..	1,124
" "	— " 22	..	..	1,119
SCOTLAND*				
Weekly average—	October	..	..	2,178
Week ended	—November 1	..	..	2,079
" "	— " 8	..	..	2,049
" "	— " 15	..	..	2,131
" "	— " 22	..	..	2,217

* Sides consigned to London.

TOTAL LONDON SUPPLIES (<i>All sources</i>)						<i>Number of sides</i>
Weekly average—October	..	..	..	..	..	4,832
Week ended —November 1	..	..	..	..	..	4,963
" " — " 8	..	..	..	..	..	5,292
" " — " 15	..	..	..	..	..	5,410
" " — " 22	..	..	..	..	..	5,401
BIRMINGHAM						
Weekly average—October	..	..	..	..	..	384
Week ended —November 1	..	..	..	..	..	404
" " — " 8	..	..	..	..	..	501
" " — " 15	..	..	..	..	..	476
" " — " 22	..	..	..	..	..	486

The scheme in London continues to make satisfactory progress. The number of sides graded and marked in London and at Birkenhead during the week ended October 25 constituted a record.

An analysis of the average daily wholesale prices of beef on the London Central Market, Smithfield, during September, 1929 and 1930, shows that, whereas the prices of English and Scotch-killed beef are appreciably higher now than they were a year ago (*i.e.*, before the commencement of the National Mark Scheme), the prices of imported chilled beef have fallen considerably. There was an average increase in September last of 5d. per stone for Scotch-killed beef and 3d. per stone for English. (A difference of 4d. per stone on a medium-weight carcass of, say, 80 stone amounts to £1 6s. 8d.)

As a result of a recommendation in the Report* of the Inter-Departmental Committee on the Grading and Marking of Beef, arrangements are being made, in conjunction with the Department of Agriculture for Scotland, for the grading and marking, at Smithfield Market, London, of Scotch beef received from centres other than north-east Scotland, where grading facilities are provided at the point of despatch.

There was a substantial increase in the numbers of sides graded and marked at Birmingham during October. The weekly average number of sides is now higher than in May last—*i.e.*, before the local difficulties.

National Mark Apples and Pears.—At the Imperial Fruit Show, held at Leicester from October 24 to November 1, National Mark apple and pear packers gained some remarkable successes, and 75 per cent. of the special prizes were awarded to them, whilst in the other classes open to them they gained 60 per cent. of the total awards. Of especial interest were the entries for the "United Kingdom Championship," Class 2 (50 half-boxes of dessert apples, representing approximately

* Cmd. 3648.

$\frac{1}{2}$ ton of fruit) and Class 6 (50 boxes of culinary apples, representing approximately 1 ton of fruit), in which all six prizes were gained by National Mark packers. In the British Empire Class for apples (open to the Empire), the following results were recorded :—

Class 1—(10 or 25 boxes of dessert apples), first and third prizes gained by National Mark packers.

Class 2—(10 or 25 boxes of culinary apples), first, second and third prizes gained by National Mark packers.

The Second Prize-winner in Class 1 has since been enrolled in the National Mark Scheme.

The trade stands generally displayed a large proportion of National Mark packs.

National Mark Canned Fruit, Peas and Beans.—The Minister has appointed Mr. G. W. Cadbury to be an additional member of the National Mark Canned Fruit Trade Committee as representative of the canning industry.

The following firms have been added to the list of authorized canners :—

J. & J. Beulah, Ltd., Boston, Lincs.

The Lincolnshire Canners, Ltd., Boston, Lincs.

At the present time, of about 30 canners of recognized standing in the industry, no less than 16 canners, operating 21 factories, are enrolled in the Scheme. It may be said that only 2 or 3 important canners with substantial output are now operating outside the Scheme.

The experience of authorized canners, even in the brief period during which the Scheme has been operative, has been very encouraging and they appreciate the benefits accruing from the association of their produce with the Mark, which has proved a definite selling force. This fact is confirmed by representatives of the distributive trade who also pay tribute to the value of the Mark, both in wholesale and in retail trade, and comment upon the discrimination of consumers in indicating their preference for National Mark canned goods. Apart from the intrinsic merits of National Mark canned produce, the growing public demand has undoubtedly been stimulated by the wide publicity undertaken by the Ministry. There is, therefore, every reason to anticipate rapid developments in the canning industry and reports have recently come to hand of the projected erection of new factories by authorized canners in various parts of the country. This augurs well for the future, and must react beneficially to home fruit growers.

{:

The undoubted success of the Scheme in its present limited

application encourages the idea of extension; first, to other fruits and vegetables suitable for canning and, secondly, to bottled fruits. The possibilities are being investigated by the Ministry and it is hoped that there will be developments before next season. Other questions bearing on the administration of the Scheme, *e.g.*, the standardization of containers, their weight content, etc., are also under consideration, as having a definite bearing upon the appeal of National Mark produce to the distributive trade and to the public.

Finally, the inspection of National Mark supplies, both in factories and on distributors' premises, is being undertaken, and the samples so far examined indicate that in the main the high quality standard associated with the Mark is being well maintained in this the first season of operation. It will be appreciated that this factor is essential to the maintenance of the reputation of the Mark and the future development of the Scheme.

National Mark Wheat Flour.—Representative samples of wheats from the 1930 crop, with samples of the earliest millings of flour therefrom (to National Mark standards), have been obtained from various parts of the country. The flour samples were analyzed at the Government Laboratory, and in ash content, moisture content and grade were considered to be equal to the average of similar samples from last year's crop. The wheats were found to have a slightly higher moisture content. The samples, with the analysts' reports, have been considered by the National Mark Wheat Flour Trade Committee, who formed the opinion that the flour milled from 1930 wheat would probably be superior in bread-making qualities to that milled from the 1929 crop.

The Minister has decided, with the concurrence of the Trade Committee, to modify the conditions applicable to repackers enrolled in the scheme. In future, application for enrolment may be made by any repacker who packs and sells a minimum quantity of 10 cwt. of flour per week, or who can produce evidence that during a period of six months before application he has purchased a weekly minimum of one sack (280 lb.) of National Mark flour for re-sale. It is hoped that the reduction of the minimum quantity qualification from 50 cwt. per week to 10 cwt. per week will broaden the channels of distribution of National Mark flour, especially in country districts.

National Mark Cider.—The provisional scheme for the application of the National Mark to cider made from apples

and pears grown in England and Wales has now been circulated to cider manufacturers and others interested. National Mark cider will be of two grades. Participation in the scheme is voluntary, and application for authority to apply the National Mark may be made by (a) manufacturers of cider (no restriction as to volume of output); (b) farm-makers of cider for sale whose annual output is not less than 3,000 gallons and involves the use of not less than 20 tons of apples and pears grown in England and Wales; (c) associations of farm-makers of cider (special rules are prescribed for such associations); and (d) bottlers who purchase National Mark cider in bulk from authorized makers for bottling under the National Mark and who bottle not less than 3,000 gallons of cider annually.

Copies of the scheme (Marketing Leaflet No. 22) can be obtained, free of charge, on application to the Ministry.

Publicity for National Mark Produce.—The sixteenth, and last, National Mark Week arranged for the present year was held at Cambridge from October 27 to November 1. The Ministry's display of National Mark products at the Central Hall, which created considerable interest and was visited by a large number of people, was supplemented by window displays by retailers, prizes being awarded for the best displays. Valuable assistance was rendered by the Cambridge Chamber of Commerce.

During October, the principal London stores arranged special displays of Empire goods in connexion with the Imperial Conference. Opportunity was taken to promote displays of National Mark products as part of the general Empire displays, and useful publicity was secured in this way. A photograph of one of the displays is reproduced here.

An excellent opportunity for bringing the National Mark prominently before the London public was afforded by the Lord Mayor's Show on November 10, the principal theme of which was Empire produce. The leading car in the Imperial section of the procession was an exhibit specially designed by the Ministry to illustrate the advantages of buying home-grown foodstuffs, fresh from the countryside, guaranteed as to origin and quality by the National Mark. Seated in front of the car, which was drawn by four grey horses, was the figure of Britannia. Two stalwart heralds bearing National Mark symbols constituted the advance guard. Inside the car, John Bull was at a counter indicating to a lady shopper the manifold advantages of buying the National Mark produce displayed on the car. Four attendants in rustic costumes

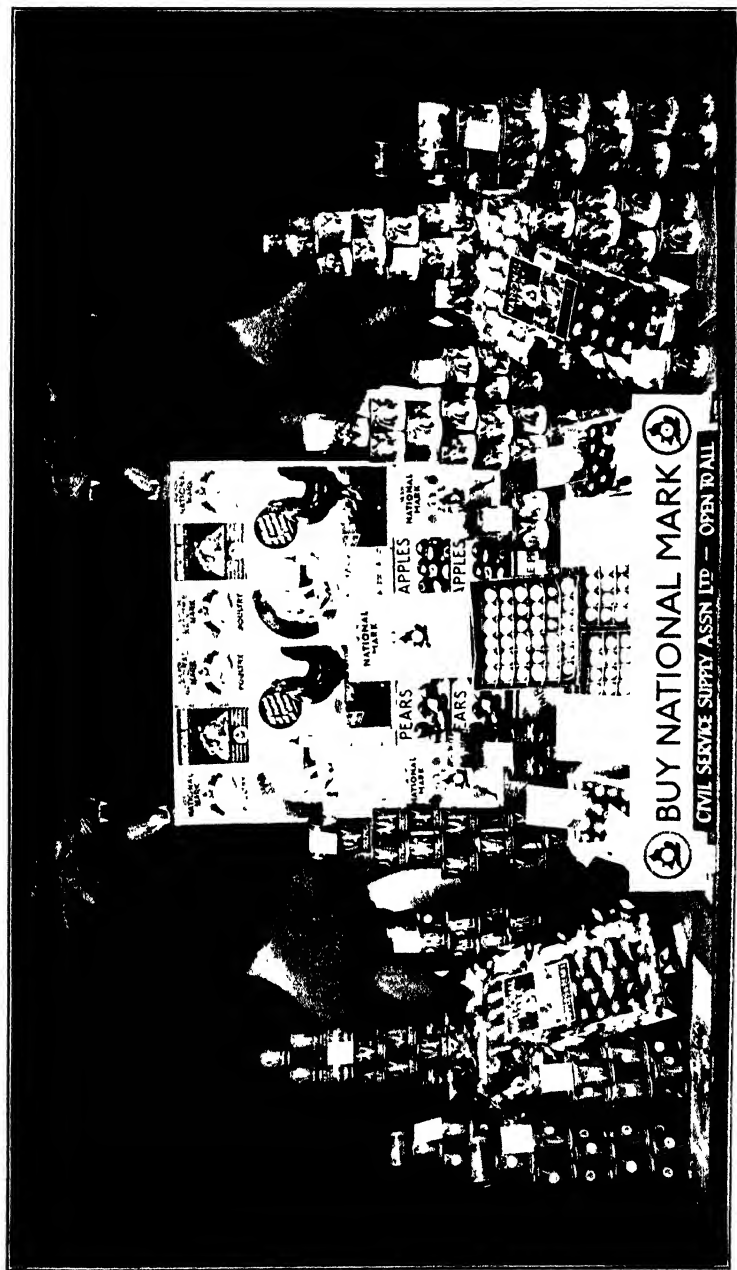
followed the car, carrying National Mark banners. Photographs of the tableau are also reproduced here.

Under the joint auspices of the National Federation of Women's Institutes and the Ministry, a National Mark Flour Cookery Competition has been arranged, open to members of Women's Institutes in England and Wales. The competition will be conducted on a county basis, each County Federation having a separate competition open to individual members of affiliated Institutes. Proficiency certificates will be awarded to competitors who attain a high degree of efficiency. Certificates will also be awarded to the three Institutes in each County Federation which secure the highest percentage of proficiency certificates in relation to total membership. Following the County competitions, which are to be completed not later than April 30, 1931, it is proposed to hold an Inter-County Cookery Competition, the entries to be scheduled and judged at the Grocers' Exhibition to be held at the Royal Agricultural Hall, London, in September next.

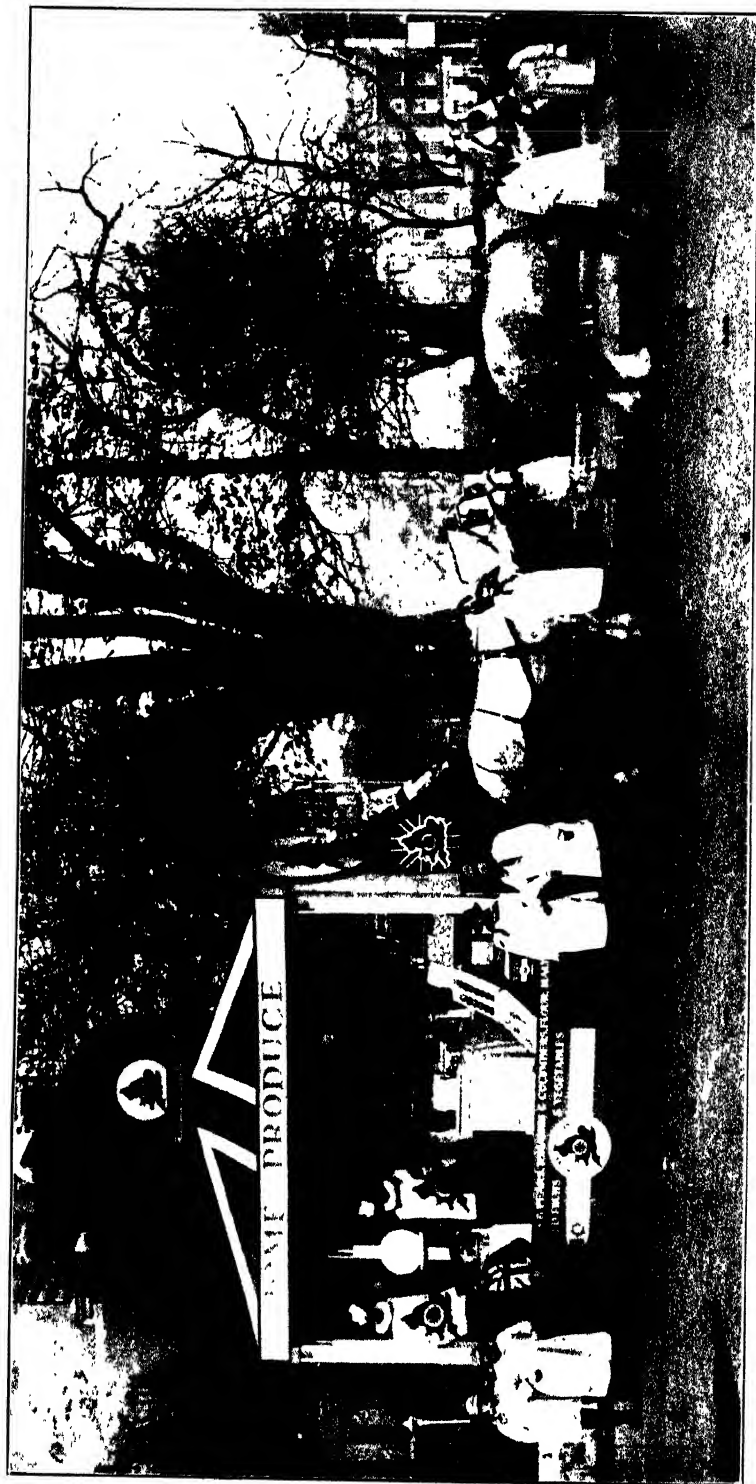
Reference was made in the November issue of this JOURNAL (p. 820) to the special lectures on the National Mark which are now being given by lecturers of the Empire Marketing Board to Women's Institutes and kindred organizations. In order to make these lectures as practical and interesting as possible, specimen packages of National Mark products with display material are shown at the Women's Institute at the time of the lecture. An illustration of the kind of display arranged is given on the inset.

In accordance with the Ministry's autumn and winter publicity programme, the advertising of National Mark products in newspapers and trade journals was commenced in October and continued throughout November. Advertising in the national and principal provincial daily newspapers calls the attention of the general public to the advantages of buying National Mark products. Special advertising in the more important newspapers circulating in the Eastern Counties is designed to appeal to farmers and other consumers in that area to buy National Mark products, especially flour, malt extract and canned fruits, and so "support local industries." Advertising in trade journals is directed mainly to producers, distributors and large users of National Mark products, *e.g.*, bakers, caterers, hotel-keepers, etc.

The advertising of National Mark beef in Birmingham newspapers was continued throughout November; this publicity was supplemented by means of addresses to women's



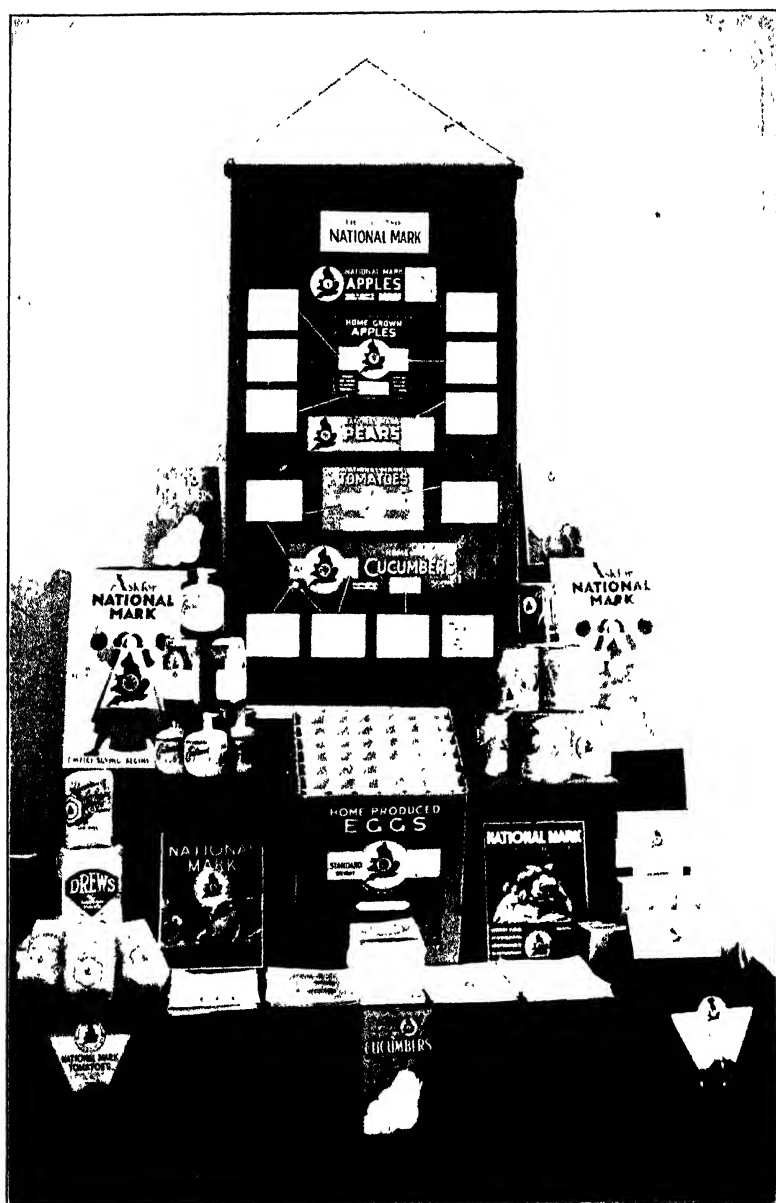
National Mark Produce: A window display at a London stores.



The National Mark Cat in the London Lord Mayor's Show, 1930.



Interior of the National Mark Car in the Lord Mayor's Show, 1930.



National Mark products display at Empire Marketing Board lectures at Women's Institutes.

organizations by trained women speakers, the showing of advertisement slides in cinema theatres and in various other ways. A window-dressing competition organized in four groups on a district basis, open to retailers who regularly stock National Mark beef, commenced on November 24 and will be concluded in the third week of December.

Displays of Home Produce.—In addition to the exhibit at Cambridge during the National Mark Week, referred to above, a display of National Mark products was staged in the Town Hall, Kendal, when two addresses on the National Mark Scheme were given on November 27 under the auspices of the South Westmorland Branch of the National Farmers' Union.

Marketing Demonstrations.—Demonstrations in improved methods of marketing agricultural produce were given during November at :—

Nantwich Cheese Fair	November 6	Cheese
Chester Cheese Fair	November 12	Cheese
Whitchurch Cheese Fair	November 18-19	Cheese
Stoke-on-Trent Fat Stock Show	November 26-27	Live Pigs and Bacon
Birmingham Fat Stock Show	November 29-December 4	National Mark Beef

At the Smithfield Show to be held at the Agricultural Hall, London, from December 8-12, graded live pigs and National Mark beef will be shown.

Report of the Imperial Economic Committee : Hides and Skins.—The sixteenth report of the Imperial Economic Committee,* recently issued, deals with the methods of preparing for market, and marketing in the United Kingdom, of hides and skins produced within the Empire. The Report presents a survey of the trade of the Empire in these raw materials with particular reference to the supply of this country's needs, and draws the conclusion that while the Empire as a whole produces a considerable surplus of hides and skins above the requirements of its leather industries, there would appear to be little scope for the substitution of Empire for foreign produce in the United Kingdom consumption.

In examining marketing methods in the United Kingdom and the overseas Empire, the Report particularly emphasizes the high proportion of inferior produce coming on the market, largely as a result of indifferent flaying combined with damage to the skin of the living animal by pests, such as "warbles,"

* Obtainable from H.M. Stationery Office, price 6d. net.

or, in some of the Dominions, by branding. It is noted, however, that "the hides of animals killed at abattoirs in the big towns are generally of higher quality than those from private slaughter-houses. The concentration of slaughtering at properly equipped centres leads to greater care and efficiency in flaying and preparing the hide. The 'packer' hides in Canada run better than those coming from farms and country butchers; the best hides from the Argentine are those from the frigorificos; the economic value of the New Zealand calf skins has been greatly increased in recent years by concentrating slaughter at the freezing works. It seems inconceivable that the greater concentration of this work in the United Kingdom, as advocated by the Ministry of Agriculture, could have other than similar results, quite apart from the opportunities it would provide for the better sale of the offals of the animals."

The high proportion of defective hides and skins results in heavy loss to the producers, and opens the door to permanent competition from leather substitutes. With the object of improving the general level of quality, the Report emphasizes the need for better organization in the collection of hides, and for instruction of the farmer and the local butcher in the methods of preventing damage to hides either while the animal is alive or in the processes of preparation. Good work is being done in the direction of education in practically every Empire country. The Report emphasizes, for example, the excellent work done in the United Kingdom by the Hide, Leather and Allied Trades Improvement Society—a voluntary association of hide-market owners and tanners. This society, *inter alia*, has used its influence towards establishing a system of uniform grading of hides, and gives flaying demonstrations and personal instruction to slaughtermen. The recommendations of Commissions in Australia and of the Skin and Hide Industry Advisory Board in South Africa, the proposal in India for an export company to provide funds for improvements in preparation and marketing, and the intensive education undertaken by the Government in Nigeria, are also noted.

The observance of uniform grades—in which, as the Report indicates, progress is being made in this and other Empire countries—apart from its facilitation for trade, should stimulate the producer to give better attention to the condition of his product, always provided that he receives a premium for the better article. "To this end," the Report states, "purchase

by mere weight or number should be everywhere discontinued." The progress made in Nigeria, where two grades of hides, distinguished by special marks, have been established, and where exporting firms pay higher prices for the better prepared hides, is held up as an example to countries higher up the scale of economic development. In this country, the Hide Improvement Society has secured the establishment of a system of prices in the markets whereby hides free from warble are quoted at a premium. Where such premiums exist, the problem is to bring the difference in value back to the farmer. As the Report points out, "the method of organization for the achievement of this object must vary with the circumstances for each country." So far as this country is concerned, it may be added that this problem, together with others that face the live stock industries, depends largely for its solution on the development of a system of centralized slaughtering.

United States Department of Agriculture: Foreign Intelligence Service.—A statute has recently been enacted "to promote the agriculture of the United States by expanding in the foreign field the service now rendered by the United States Department of Agriculture in acquiring and diffusing useful information regarding agriculture and for other purposes." The information required is that concerned with "world competition and demand for agricultural products and the production, marketing and distribution of these products in foreign countries." The "other purposes" includes the demonstration (abroad) of standards for cotton, wheat and other American agricultural products.

Latvia: Breeding of Pigs.—An Order dated July 31, 1930, discloses that, in order to promote the breeding of pigs, the Latvian Government will pay a premium to pig breeders for pigs of certain grade standards delivered to the export slaughter-houses, such premium to be paid when sale prices for Latvian bacon in the London market fall below 86s. per cwt. The amount of premium payable is from 12s. to 16s. per pig.

The classification of the pigs killed for bacon is to be made by a committee appointed by the Minister of Agriculture and comprising the director of the slaughter-house, the master-slaughterer, and the veterinary inspector (Controller of Meat for Export), the last-named having the right of veto.

Standards for Jam.—A scheme, drawn up by the Food Manufacturers' Federation, to establish certain standards for jam, came into operation on November 1, 1930.

Two standards are prescribed, namely, "Full Fruit Standard" and "Lower Fruit Standard," for first and second quality jams, respectively.

The basis of both these standards is (a) a minimum percentage of soluble solids, and (b) a minimum fruit content for each variety of jam.

Included in the term "soluble solids" are the sugars, both added and natural to the fruit, and soluble substances present in the fruit.

With regard to the fruit content, two schedules have been drawn up for jams of the first and second categories respectively, providing in each case for a fixed minimum percentage of fruit required to be present in the finished jams.

Provision is also made for jam packed under the scheme to bear a label on which is printed the standard, whether "full" or "lower" fruit, and a guarantee that the jam conforms to the appropriate fruit standard of the Food Manufacturers' Federation. The presence of fruit juice in the lower fruit standard jams must be boldly indicated on the labels by the words "with other fruit juice" in letters of a size equal to that of the named fruit or fruits. In the case of mixed jams, where the proportions of fruit are not equal, the name of the fruit forming the larger content must appear first in the description on the label.

The regulations as to fruit content and methods of labelling also apply to fruit jellies.

Only manufacturers who have given a written undertaking to observe the standards are permitted to use the foregoing descriptions on their labels.

Economic Series (Marketing Reports).—With the issue on November 12 of the Report on the *Marketing of Dairy Produce in England and Wales, Part I—Cheese*—a review of which was included in the November issue of this JOURNAL—the Reports issued in this series now number 24. Approximately 84,000 copies of these well-known Reports have been sold and four numbers have been sold out. Several other numbers are nearly sold out (only a few copies being left of No. 5—*Co-operative Purchase of Agricultural Requisites*) and as it is not the Ministry's intention to reprint any of the Reports, those desirous of obtaining copies of any particular numbers to make up a set of the Reports would be well advised to order at once. A list of the Reports issued and about to be issued may be obtained on application to the Ministry.

DECEMBER ON THE FARM

WILLIAM LAWSON, M.B.E., N.D.A., N.D.D.,

Director of Agriculture for West Sussex.

WORK on arable land is now limited in scope. In the north, ploughing of leys for spring corn proceeds throughout the winter unless stopped by frost. Such an interference is often welcomed to allow of the carting of farmyard manure. In the south some wheat may be sown, but the principal work is the ploughing of fallows. There are too few opportunities for carting under frosty conditions : the mild winters so prevalent in the south are not unmixed blessings, and much of the arable land would benefit materially from more frequent frosts.

Grass Land.—The grass land should have attention now when few opportunities occur for useful work on arable land. Grass land is variously described, and such terms as pasture and meadow have not universal meanings. In some districts the whole of the enclosed grass is referred to as meadow land, and in others this term is confined to the grass land that is usually mown for hay, whilst that devoted to grazing is called pasture. Low-lying land adjoining rivers or streams is sometimes called brooks or holms or simply meadows. Grass in rotation is often referred to as upland pasture and the hay from it as upland hay, whereas the hay from permanent grass is referred to as meadow hay. In some districts where a fairly long rotation is practised the grass land may exist for from three to six or more years. In such cases the hay in the first and second years is often referred to as seeds hay, ryegrass hay or mixture hay, but in the later years the hay product is usually termed meadow hay.

There is also in use a considerable amount of what are described as rough grazings. These are mainly hill grazings and downland grazings on land that has never been under arable cultivation, but also includes much land that apparently was under the plough in the early years of the nineteenth century and is still being added to by land which was under the plough at a much later date. The area of land returned as rough grazings is increasing year by year, and this may be taken as indicating that a substantial area of grass land has been more or less left to natural conditions and all artificial treatment abandoned. This class of grazing is in many cases the result of neglect. Its situation and quality may be such that expensive treatment is not justified, but suitable treatment need not be expensive and might prove more remunerative

than the same expenditure on better land. Land that has been classified as under crops or grass and has drifted into the rough grazing class should be worth rescuing. The individual circumstances must be known in order to prescribe the appropriate remedy.

Deterioration may be first evident in the unpalatable nature of the herbage that is not readily eaten by stock ; this rough grass is allowed to die down year after year and a matted turf is formed, accompanied by a further depreciation of the quality. Deterioration may also be accompanied by the growth of briar, bramble, thorn and other shrub growth. Molehills and anthills may also abound and the growth of bracken is not an unusual cause of trouble. Such extreme cases require reclamation at considerable capital expenditure and may not be worth it. Early deterioration should be checked.

Unpalatable grass is produced under many circumstances. The grasses may be of poor type, mechanical treatment of the land may be needed, or one or more of the essential manurial ingredients may be deficient ; but very often the result is due to a combination of these causes. The first aim must be to bring about a change in the nature of the grass and render it more palatable. Manuring will usually bring about the desired change, but the conditions must be such as to give the manures a fair chance. Manures will not give satisfactory results when applied on the top of a mass of rough decaying grass ; they must get into contact with the soil. The change desired is the encouragement of wild white clover, and this cannot develop unless the runners are in contact with the soil and the plant exposed to the light. Grass should be eaten off as bare as possible, and if this is not practicable without causing depreciation of the grazing stock then cultivations must be carried out. Rough grass will require drastic treatment ; the disc harrow and heavy toothed harrows may be relied on to produce the necessary condition. The cultivations given are frequently not severe enough, and whilst the cure may appear drastic, the greater the need the less is the risk of damage being done by severe cultivation. Land that can be described as rough grazing is not likely to be mown for hay and consequently the loose rough material produced by the cultivations need not be carted off but can be left to rot on the ground. Cultivations alone will produce improvement, but to prevent a rapid recurrence of the same conditions manures will be required. The County Agricultural Organizer, having knowledge of the rainfall and soil conditions, should be invited to

prescribe an effective and economic method of manuring, and may be relied upon to help.

The proper consolidation of the land must also be attended to. Rolling is often abused, but opportunities should be chosen when the weather and soil conditions are suitable for compressing the soil without leaving it in a hard caked condition.

All grass land requires proper management and attention if it is to maintain full productiveness. The less suitable the land for pasture growth the more attention is required. Old established pastures on good land and carrying a mixed stock may require very little attention beyond judicious grazing, the cutting of thistles and an occasional harrowing. A few of the mistakes made in the treatment of grass land may be reviewed.

The meadow which is mown for hay year after year may deteriorate from two main causes. Mowing late in the season year after year tends to develop a particular type of herbage, usually of a coarse and innutritious nature. Late mowing may also encourage the growth of yellow rattle, a parasitic weed which, besides being useless in itself, injures the grasses. Where an extensive area of meadows is mown each year the order in which the fields are mown should be varied so as to avoid as much as possible the deterioration which results from late mowing. Another cause of deterioration in regularly mown meadows is insufficient feeding of the aftermaths. Autumn grazing is advantageous; grazing by cattle helps to consolidate the land, and close grazing gives the finer grasses and clovers a better chance, so that the tendency to coarseness which is encouraged by mowing is counteracted. A well grazed aftermath also leaves the land in suitable condition for the application of manures or for harrowing.

On average quality pastures annual treatment is important. The abundant autumn growth of grass is sometimes difficult to dispose of, and attention should be concentrated first on the fields that it is proposed to treat with manure. Land that is not in immediate need of manure may be close grazed at a later date, but some time during the winter the old grass should be cleaned off and the land well harrowed with spiked harrows. Manuring of pasture land should be practised in rotation; a good plan is to manure one-fourth each year and so distribute expenditure and labour uniformly from year to year. Such a procedure is a well tried system and may be relied on to give profitable returns and to maintain the pastures in good condition with the minimum of expense.

Intensive manuring of grass land with complete mineral manures each year, followed by repeated dressings of nitrogen during the growing season, is still on its trial, and whilst it is worthy of full investigation, and is possibly beneficial where the area of grass land available is limited, there is so much grass in need of the less frequent manuring that this should have first attention.

New Permanent Grass.—One type of grass land which has increased in late years has not been specifically mentioned. Land laid down to permanent grass not infrequently deteriorates after a few years. Frequent applications for advice are received on this subject. Much of the land now in this stage was ploughed out of grass during the war years, and having proved rather difficult under arable cultivation has been laid down again to grass or has been allowed to tumble down as soon as possible. Good land in good physical and manurial condition is usually fairly easily laid down to pasture, and instances of land tumbling down to pasture of a satisfactory character are not infrequent. Many circumstances may account for the deterioration of new pastures. The condition of the land when seeded out may have been such as to interfere with the sown seeds, the tilth having been poor, or weather conditions adverse, or the cover crop laid, or the land not free from weeds or inadequately manured. The seed mixture may have been unsuitable and the character of the grasses short-lived.

Whatever the cause, wherever deterioration of this character is severe, the remedy is not simple. Old established pastures have a basis of pasture plants to work upon and these can be fostered by suitable treatment. A worn out pasture may be so deficient in desirable pasture plants as to render the ordinary methods of improvement quite ineffective. The obvious course to pursue would be to plough the land and put it through a course of cropping and re-seed under better conditions. The cost of such a process is considerable, and if the land is not well suited for arable cropping such a procedure may not be justified. The alternative is to attempt to renovate the pasture with a suitable mixture of seed. This method is attended by risks and is not always successful. The first requirement is to get rid of as much as possible of the existing herbage and to make a tilth. Disc harrows, drag harrows or heavy-toothed harrows should be used freely. This work should be done during the winter months, but the sowing of the seed should

be delayed until early April in the south, and possibly till later in the month farther north.

A general mixture that can be recommended is 16 to 20 lb. of perennial rye-grass and 1 to 2 lb. of wild white clover. This should be harrowed in during showery weather and the land rolled when dry enough. The field should be kept free of stock and be mown over about the end of July, after which cattle may graze it without doing damage. Manuring should be undertaken either at the time of seeding or in the following autumn. Grazing in the following year is preferable to mowing.

NOTES ON MANURES

H. V. GARNER, M.A., B.Sc.,
Rothamsted Experimental Station.

Chalking Experiments.—It is well known that, when land is acid, the addition of chalk or lime in sufficient quantity will produce an improvement, varying in degree according to the original shortage. On the one hand, the improvement may be relatively slight, and be reflected in more certain and uniform crops, a better state of cultivation, and greater freedom in the choice of artificial fertilizers. In other cases completely new possibilities are opened up, and crops which formerly were quite out of the question can be grown with success. In spite of this, however, experiments in chalking are far fewer than with artificial fertilizers, and such as are recorded from time to time are therefore of special interest. Recently Mr. A. W. Oldershaw* has published an account of chalking experiments on the very light, acid soil at Tunstall in Suffolk, of which many thousands of acres exist in that district. A four-course rotation of lupins, rye, roots (sugar beet and potatoes) and oats was laid down on duplicate plots. Half of each plot received chalk at the rate of 5 tons per acre in the autumn of 1926, the other half being untreated. The rotation was similarly manured with artificials on the chalked and unchalked areas, and yields for each crop of the rotation are reported for the three years following. A general picture of the results may be obtained from Table I in which the average yields per acre of the three seasons are given.

* *Jour. Roy. Agric. Soc. Eng.*, Vol. 90, 1929.

TABLE I

			<i>Chalked</i>	<i>Unchalked</i>
Rye	grain	..	29.5 cwt.	25.4 cwt.
	straw	..	47.5 "	42.7 "
Sugar beet	roots	..	10.35 tons	Failed
Potatoes		..	12.95 "	8.75 tons
Oats	grain	..	26.1 cwt.	25.6 cwt.
	straw	..	29.5 "	29.5 "
Lupins (1929)	grain	..	24.6 "	22.5 "

It will be seen that in the case of rye, potatoes, oats, and lupins, good crops have been obtained by the use of artificial fertilizers in conjunction with lupins ploughed in even on the acid soil. The improvement by liming was considerable in the potato crop, especially in the very dry season of 1929, for drought increases the bad effects of soil acidity. The crops in question are those which tolerate a considerable degree of acidity. Sugar beet shows quite different behaviour; without chalk the crop is a failure, the land is covered with spurrey, and only isolated and stunted plants of beet survive—a demonstration of the effects of soil acidity quite as striking as the classical example on grass at Rothamsted and on barley at Woburn.

Information relating to the growth of other crops has also been obtained. It may be summarized as in Table II.

TABLE II.—YIELDS IN 1929

			<i>Chalked</i>	<i>Unchalked</i>
Wheat	grain	..	25.6 cwt.	20.2 cwt.
Barley	grain	..	24.9 "	3.2 "
	straw	..	23.0 "	4.0 "
Lucerne hay (inoculated)			40.0 "	Failed

Observation plots further showed that chalking trebled the crop in the case of mustard, and that white turnips failed on the acid land, but produced a useful crop where chalk had been applied. The cost of the dressing of 5 tons of rough chalk, together with application, was estimated as 50s. per acre.

Another type of liming experiment, bringing out the effect of increasing quantities of carbonate of lime in a replicated trial carried out on modern lines, has been reported from Harper Adams College.* Applications of carbonate of lime to an acid soil on the Bunter Sandstone were made in the spring of 1928 at rates ranging from nothing to 5 tons per acre.

In 1929, barley was sown and yields were obtained as indicated in Table III.

* West Midland Province: *Advisory Chemists' Report*, 1929.

TABLE III

		<i>Grain</i>	<i>Straw</i>
No carbonate of lime ..		10.86 cwt.	10.87 cwt.
25 cwt. carbonate of lime..		17.60 "	15.52 "
50 " " " ..		18.67 "	16.55 "
100 " " " ..		20.12 "	19.45 "

The great improvement comes with the first dose, after which the further increases are small. There are, as a rule, no ill-effects following an application of liming materials in excess of the quantity actually required. Nevertheless, at a time such as the present, when outlay is being kept down to a minimum, farmers would always welcome information as to the least quantity of chalk or lime necessary to produce the desired effect.

Further experiments on the above lines, bringing out the response of various soil types to increasing applications of lime, are needed in many parts of the country.

Magnesian Lime.—The bulk of the lime used for agricultural purposes is produced from limestone containing about 90 per cent. of carbonate of lime or from chalk of similar analysis; the resulting quicklime contains about 90 per cent. of oxide of lime. Extensive deposits of magnesian limestone occur in Nottinghamshire, Yorkshire and Durham, in situations which are convenient for agricultural purposes. These limestones contain from 3 up to 40 per cent. of magnesium carbonate according to their place of origin, and when burnt in the ordinary way they yield limes containing corresponding percentages of magnesia. The question of the suitability of magnesian limes for use on the farm has often been discussed, and cases are on record where damage has resulted from heavy applications. Experience gained in Yorkshire with these limes* leads to the conclusion that on heavy soils there is no danger if the application is limited to 3 tons per acre. On light soils poor in organic matter, and on soil already rich in magnesia, such as those derived from the magnesian limestone, they should not be employed. The magnesia has a similar action to quicklime in neutralizing soil acids—in fact weight for weight it is somewhat more effective—but it appears to remain longer in the soil in a caustic condition. The magnesian limestones when unburnt but ground to a fine powder have behaved in much the same way as ordinary limestones in American experiments conducted over an eleven-year period on a rotation of crops. There was no ill-effect

* J. A. Hanley : *Leeds Bull.* No. 107.

due to the magnesia. In districts removed from the magnesian formation the question of the use of these limes does not arise, as ordinary lime from local sources will usually be available.

Residual Effects of Fertilizers.—Experiments designed to bring out the residual effects of fertilizers are not so numerous as those in which the first year's action is ascertained. An early experiment designed to test the second-year effects of nitrogenous and of mineral fertilizers was carried out on the Broadbalk Field at Rothamsted on wheat. The manures tested were sulphate of ammonia, and "minerals"—i.e., superphosphate and salts of potash—and they have been applied to certain plots in alternate years over a long period. In the year in which nitrogen was given, the residual effect of the minerals applied over previous years was ascertained, and *vice versa*. The average yields over a 74-year period are as follows :—

Years in which sulphate of ammonia (86 lb. N.) was applied (i.e., residues of minerals) ..	27.7	bu.
Years in which minerals were applied (i.e., residues of nitrogen)	12.5	"
Minerals and nitrogen applied together every year	32.1	"
Minerals only every year	11.5	"
Nitrogen	17.8	"

It will be seen that, on the Rothamsted soil, the residues of previous mineral manuring have been almost sufficient for the wheat, while the after-effects of a long course of nitrogenous manuring have been negligible.

The Woburn results afford similar evidence of the smallness of the residual effect of quick-acting nitrogen (41 lb. per acre) although in this case yields do not drop quite to basal level in the years when no nitrogen is given. Minerals were supplied each year, but the nitrogenous fertilizers were given in alternate years.

BUSHELS PER ACRE, 1882-96

	Wheat	Barley
Minerals with sulphate of ammonia applied ..	20.0	21.1
" " " " omitted ..	12.3	14.7
" " nitrate of soda applied ..	17.3	23.1
" " " " omitted ..	8.6	14.8
" only	7.8	10.4

Few other experiments along these lines have been reported, but a somewhat similar trial has been conducted by Professor Hendrick, at Craibstone,* in which the crop was potatoes and

* *Trans. High. Agric. Soc.*, 1926.

potash manures were in question. A series of plots had received equivalent applications of potash in seven different forms in the four years, 1921-24. In 1924, however, one section of each of the potash plots was left without potash,

PRICES OF ARTIFICIAL MANURES

Description	Average prices per ton during week ended November 12				
	Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) ..	9 12d	9 12d	9 12d	9 12d	12 5
Nitro-chalk (N. 15½%) ..	9 7d	9 7d	9 7d	9 7d	12 1
Sulphate of ammonia :—					
Neutral (N. 20·6%) ..	9 3d	9 3d	9 3d	9 3d	8 11
Calcium cyanamide (N. 20·6%) ..	8 9e	8 9e	8 9e	8 9e	8 2
Kainit (Pot. 14%) ..	3 6	2 19	2 18	3 1	4 4
Potash salts (Pot. 30%) ..	5 3	4 18	4 18	4 15	3 2
" (Pot 20%) ..	3 15	3 9	3 6	3 9	3 5
Muriate of potash (Pot. 50%) ..	9 10	9 3	8 16	9 1	3 7
Sulphate,, (Pot. 48%) ..	11 11	11 6	10 17	11 0	4 7
Basic Slag (P.A. 15½%)|| ..	2 13c	2 3c	..	2 9c	3 1
" (P.A. 14%)|| ..	2 7c	1 16c	1 16c	2 3c	3 2
" (P.A. 11%)|| ..	..	1 9c	1 9c	..	..
Ground rock phosphate (P.A. 26-27½%)|| ..	2 2a	2 10a	2 5a	2 7a	1 9
Superphosphate (S.P.A.16%) ..	3 11	..	3 9	3 6	4 2
" (S.P.A.13½%) ..	3 5	2 18	3 3	3 0	4 4
Bone meal (N.3½%, P.A.20½%) ..	8 15	8 10	8 7	6 12	..
Steamed bone flour (N. ½%, P.A. 27½-29½%) ..	5 17b	5 15f	5 15	4 7	..
Burnt Lump Lime ..	1 5l	1 2m	1 9	1 17h	..
Ground Lime ..	1 12l	1 8m	..	1 12h	..
" Limestone ..	1 3l	1 6g	1 8k	..	..
" Chalk ..	..	1 6g	..	1 11h	..
Slaked Lime ..	..	..	2 9	2 17h	..

Abbreviations: N.=Nitrogen; P.A.=Phosphoric Acid; S.P.A.=Soluble Phosphoric Acid; Pot.=Potash.

* Prices are for not less than 6-ton lots, for delivery during the month, at purchaser's nearest railway station, unless otherwise stated. Unit values are calculated on carriage paid price.

† Prices are for not less than 2-ton lots, net cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. price.

|| Fineness 80%, through standard sieve. a Prices for 6-ton lots f.o.r. at makers' works.

b Delivered (within a limited area) at purchaser's nearest railway station.

c Prices for 6-ton lots; at Bristol, f.o.r. Bridgwater; at Hull and Liverpool, f.o.r. neighbouring works, and at London f.o.r. depots in London district.

d For lots of 4 tons and under 6 tons the price is 1s. per ton extra and for lots of 2 tons and under 4 tons 5s. per ton extra.

e Delivered in 4-ton lots at purchaser's nearest railway station.

f Delivered Yorkshire stations.

g F.o.r. Knottingley. Ground limestone 100% through standard sieve.

h Carriage paid 6-ton lots London, bags included.

k In bags, f.o.r. Liverpool. Fineness 45% through standard sieve.

l Carriage paid 6-ton lots Bristol.

m Carriage paid 6-ton lots Knottingley.

but received its usual application of the other nutrients. The mean yield, in 1924, of the seven plots which had received potash since 1921 was 9.2 tons of potatoes, while the seven sections which had been deprived of their potash averaged 7.0 tons. In this case, although other evidence indicated that the soil was not highly responsive to potash, there was insufficient potash left over to grow a full crop of potatoes. That the result of three years' potash applications had been considerable, however, is brought out by comparing the yield in 1924 of the plots which had not received potash at all (4.1 tons) with those which had been deprived of potash in that year only (7.0 tons).

* * * * *

NOTES ON FEEDING STUFFS

H. G. SANDERS, M.A., Ph.D.,
School of Agriculture, Cambridge.

Dry Cows.—Last month's notes were devoted to a description of two aspects of the question as to how long cows should be dry between lactations. The dry period gives them a chance to redress the adverse balance of food materials during the previous lactation and to put up stores in preparation for the next; it also allows the gland a fair chance for recuperation and renewal for the approaching period of activity. Neither process is properly understood, but it would seem that the progress of the former can be greatly accelerated by high feeding during the closing stages of the previous lactation and while the cow is dry; nevertheless, even with the most thorough "steaming up," the latter will always necessitate an interval of inactivity between milking periods, and appears to need 6 weeks, or thereabouts, for its full completion.

The few figures given last month show how large is the effect of the rest period on the next lactation yield, and how serious are the losses that are occasioned by failure to keep its length closer to what is admittedly the optimum—6 to 8 weeks. The figures given were for cows approaching maturity—with young ones the effect is much greater still. The first dry period (in the accepted sense) that a cow gets is between her first and second lactations, and the effect of this is very much more marked than that of rests later in life. A mature cow will suffer a reduction of about 14 per cent. if allowed no rest, whereas the corresponding figure for second calvers is no less than 25 per cent. This is a serious matter; when it is pointed out that this means that she will give only 600

gallons in place of 800 gallons if she had been dry for six weeks no further emphasis is needed. The really calamitous part of the story lies in the fact that in practice it is just these second calvers that are the ones to miss their rightful amount of rest.

This state of affairs is not fortuitous, as there are two factors that tend to bring it about. The first is the very decided tendency that heifers exhibit to long lactation in their first milking period—leading, of course, to a shorter dry period after it. The second is the belief held by some dairy farmers that the long lactation habit should be ingrained during the first lactation, which induces them to keep on milking heifers longer than they would an older cow. There is no evidence that there is anything in this belief, and it is certain that the end result of milking heifers practically right up to their second calving is very detrimental to their subsequent performances. Indeed, it does the cow a permanent injury, for a long rest next time will have little or no effect in making up for lost ground.

The explanation of the difference between second calvers and older cows very probably lies in the question of growth—and, in particular, of growth of the udder. The growth of this gland throughout life occurs in a series of waves; after a minor development in early life, the first large increase is during the first pregnancy, and this is followed by progressively smaller increases with every succeeding pregnancy. For the full development of the potentialities of the cow every chance must be given for these growth cycles to occur, and particularly the early ones as they are the most pronounced. During the first pregnancy the largest one of all has free play, but the next largest is during the second pregnancy, and this is the one that is being hampered to a serious extent by keeping heifers in milk right up to their second calving. This view carries with it the reason that this chance of development, if lost at its proper time, cannot be atoned for by long rests later in life, when the growth stimulus is dying down.

It follows from all this that the dry period is more important before the second than before the third lactation, more important before the third than the fourth, and so on. Consequently we arrive at one qualification of the 6 to 8 weeks optimum that is logical, and the rule may be stated that fairly long periods of rest are most important for second calvers, and become less important as the cow gets older.

Also, since the primary consideration with the young cow is udder growth, it is the rest itself, rather than high feeding, that is necessary. As the cow gets older the rest itself becomes less important, and, if the milk is wanted, it may be good policy to keep her milking closer up to calving time, as long as she is fed well enough to enable her to store up food materials.

Treatment as regards dry period should, therefore, be varied according to the age of the cow. There are probably any number of other distinctions that might profitably be made between individuals, for no two cows are just alike, but only one more can at present be stated. All intermediate grades exist, but it is possible to pick out the persistent milker and the non-persistent milker. The former may not go to a very high level in early lactation, but she keeps her yield up and milks on steadily with only a slow falling off for a long time; the latter, on the other hand, may run up to 5 or 6 gallons a day soon after calving, but quickly disappoints the hopes thus raised by falling away rapidly and continuously. The two types can be recognized fairly easily, and it has been shown that individual cows have their own particular characteristics in this way, and that, though persistency is largely affected by outside factors, each cow tends to keep more or less constant in this property throughout her life; she is nearly, but not quite, as constant in persistency as she is in total yield from lactation to lactation.

Persistent and non-persistent cows react very differently to the dry-period factor. The former are very severely handicapped by complete absence of rest, but gain practically nothing by further rest than about 6 weeks; taking as before 6 weeks as a standard for comparison, the very persistent second calver drops by no less than 40 per cent. if not dry at all, while a rest of a fortnight will save all but 12 per cent., and another fortnight will reduce the loss to about 4 per cent. Thus with this type of cow it is very desirable to allow a reasonable dry period; less than a fortnight will be disastrous, and the aim should be to give about a month or 6 weeks. There is, however, nothing to be gained by wasting much more time than that.

With non-persistent cows the tale is very different. The loss following no rest is in the neighbourhood of 15 per cent., and about 3 per cent. is retrieved for every week dry. The gain in this case seems to go on indefinitely—at least up to about 4 months, after which there are few instances to test

it. With this type of cow, therefore, there is a marked difference and it is a straightforward case of "the more the merrier."

If we are to indicate the practical aspect of this the conclusions must be pushed a little further, but here it behoves us to tread very warily, for only the surface of the ground has been scratched. It appears probable that with the persistent milker the chief factor is growth of the gland, but with the non-persistent milker it is storage of food. The former is the dairy type, which always tends to put the food in the pail rather than on her back, and this agrees with the conclusion drawn by Eckles some time ago, that the chief difference between the good and the bad milker is simply that the former has the capacity for consuming large quantities of food over and above her maintenance requirements, and for using that surplus for milk production. It follows that food storage is of comparatively minor importance in her case, and all she needs is a chance to develop her udder; this is a rapid process and much of it can be effected in a fortnight, whilst it can be completed in 6 weeks.

The opposite type of cow is limited throughout by lack of food nutrients for the udder (her tendency being to put them on her back), and consequently the more chance she has to accumulate a reserve the better will be her performance. The principles to be adopted in the two cases are, then, very different. With a persistent cow it is imperative that a short rest be given, but more than 6 weeks is a waste of time and hence uneconomic. With the non-persistent cow each week's rest, presumably up to some, at present, undetermined upper limit, will increase the next lactation by about 3 per cent. Whether it will pay to give a short or a long rest under these conditions cannot be stated dogmatically. In any case the decision of the question does not commonly arise, for this type of cow helps herself to plenty of rest by drying off some time before calving. This latter is the cow that will respond best to the "steaming up" process, which will help her in the direction in which she is weakest, i.e., in keeping the yield up after the flush is past. With the naturally persistent cow, however, it is rest, rather than "steaming up," that is required; feeding during the dry period in her case will be good as far as it makes good her losses if she is in poor condition, but will not provoke much response in the next lactation.

It has always surprised the writer that scientists have taken so little interest in the effects of the dry period. Carefully controlled experiments both on the actual length of time dry and on the feeding during that period would shed much light on the mechanism of milk secretion. The matter is one of intense scientific interest, and one of those happy cases where the inquirer can satisfy his own inquisitiveness, and

Farm Values.—The prices in respect of the feeding stuffs, used as bases of comparison for the purposes of this month's calculations are as follow:—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (imported)	71	6.2	4 6
Maize	81	6.8	4 14
Decorticated ground nut cake	73	41.0	7 5
„ cotton cake	71	34.0	8 15

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 1.11 shillings, and per unit protein equivalent, 2.40 shillings. An explanation of the method of calculation employed is given in the Report of the Departmental Committee on Rationing of Dairy Cows.*

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The “food values” which it is recommended should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows are given in the November, 1930, issue of the Ministry's JOURNAL.)

FARM VALUES

Crops	Starch equivalent Per cent.	Protein equivalent Per cent.	Food value per ton, on farm £ s.
Wheat	72	9.6	5 3
Oats	60	7.6	4 5
Barley	71	6.2	4 14
Potatoes	18	0.6	1 1
Swedes	7	0.7	0 9
Mangolds	7	0.4	0 9
Beans	66	20.0	6 1
Good meadow hay	37	4.6	2 12
Good oat straw	20	0.9	1 4
Good clover hay	38	7.0	2 19
Vetch and oat silage	13	1.6	0 18
Barley straw	23	0.7	1 7
Wheat straw	13	0.1	0 15
Bean straw	23	1.7	1 10

* Obtainable from H.M. Stationery Office, Adastral House, Kingsway, W.C. 2. Price 6d. net.

DESCRIPTION	Price per qr.		Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.	Price per lb. starch equiv.	Pro- tein equiv.
	s. d.	lb.	£ s.	£ s.	£ s.		s. d.	d.	%
Wheat, British	—	—	7 5	0 11	6 14	72	1 10	0.98	9.6
Barley, British feeding	—	—	5 15	0 8	6 14	71	1 11	1.03	6.2
„ Danubian	15 3	400	4 5	0 8	3 17	71	1 1	0.58	6.2
„ Persian	15 6	—	4 7	0 8	3 19	71	1 1	0.58	6.2
„ Russian	15 3	—	4 5	0 8	3 17	71	1 1	0.58	6.2
Oats, English, white	—	—	6 7	0 9	5 18	60	2 0	1.07	7.6
„ „ black and grey	—	—	6 0	0 9	5 11	60	1 10	0.98	7.6
„ Canadian mixed feed	13 9	320	4 17*	0 9	4 8	60	1 6	0.80	7.6
„ Argentine	12 9	—	4 10	0 9	4 1	60	1 4	0.71	7.6
„ Chilean tawny	14 3	—	5 0	0 9	4 11	60	1 6	0.80	7.6
„ German	23 9	—	8 7*	0 9	7 18	60	2 8	1.43	7.6
Maize, Argentine	20 9	480	4 17	0 9	4 8	81	1 1	0.68	6.8
„ South African	19 6	—	4 12†	0 9	4 3	81	1 0	0.54	6.8
Beans, English Winter	—	—	6 10‡	1 2	5 8	66	1 8	0.89	20
Peas, Indian	—	—	9 15†	0 19	8 16	69	2 7	1.38	18
„ Japanese	—	—	17 5†	0 19	16 6	69	4 9	2.54	18
Dari	—	—	8 0	0 10	7 10	74	2 0	1.07	7.2
Milling offals—									
Bran, British	—	—	4 7	0 19	3 8	42	1 7	0.85	10
„ broad	—	—	5 12	0 19	4 13	42	2 3	1.20	10
Middlings, fine, imported	—	—	5 17	0 15	5 2	69	1 6	0.80	12
„ coarse, British	—	—	5 2	0 15	4 7	58	1 6	0.80	11
Pollards, imported	—	—	4 12	0 19	3 13	60	1 3	0.67	11
Meal, barley	—	—	5 17	0 8	5 9	71	1 6	0.80	6.2
„ maize	—	—	6 12	0 9	6 3	81	1 6	0.80	6.8
„ „ South African	—	—	5 17	0 9	5 8	81	1 4	0.71	6.8
„ „ germ	—	—	5 15	0 14	5 1	85	1 2	0.62	10
„ locust bean	—	—	6 5	0 7	5 18	71	1 8	0.89	3.6
„ bean	—	—	9 10	1 2	8 8	66	2 7	1.38	20
„ fish	—	—	18 0	2 17	15 3	53	5 9	3.08	48
Maize, cooked flaked	—	—	7 10	0 9	7 1	83	1 8	0.89	8.6
„ gluten feed	—	—	6 15	0 17	5 18	76	1 7	0.85	19
Linseed cake, English, 12% oil	—	—	9 17	1 6	8 11	74	2 4	1.25	25
„ „ „ 9% „	—	—	9 5	1 6	7 19	74	2 2	1.16	25
„ „ „ 8% „	—	—	9 0	1 6	7 14	74	2 1	1.12	25
Soya bean cake, 5½% oil	—	—	8 2*	1 16	6 6	69	1 10	0.98	36
Cottonseed cake—									
„ „ English, 4½% oil	—	—	4 5	1 4	3 1	42	1 5	0.76	17
„ „ Egyptian, 4½% „	—	—	3 15	1 4	2 11	42	1 3	0.67	17
Decorticated cottonseed meal, 7% oil	—	—	9 5*	1 16	7 9	74	2 0	1.07	35
Ground-nut cake, 6.7% oil	—	—	5 15‡	1 4	4 11	57	1 7	0.85	27
Decorticated ground-nut cake, 6.7% oil	—	—	7 5	1 17	5 8	73	1 6	0.80	41
Palm kernel cake, 4½-5½% „	—	—	5 15‡	0 15	5 0	75	1 4	0.71	17
„ „ „ meal, 4½% „	—	—	6 5‡	0 15	5 10	75	1 6	0.80	17
„ „ „ meal 1.2% oil	—	—	4 15	0 16	3 19	71	1 1	0.58	17
Feeding treacle	—	—	5 15	0 8	5 7	51	2 1	1.12	2.7
Brewers' grains, dried ale	—	—	4 5	0 16	3 9	48	1 5	0.76	13
„ „ „ porter	—	—	3 17	0 16	3 1	48	1 3	0.67	13
Malt culms	—	—	5 10†	1 4	4 6	43	2 0	1.07	16
Dried sugar beet pulp	—	—	5 7	0 8	4 19	65	1 6	0.80	5.2

* At Bristol.

† At Liverpool.

‡ At Hull.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of October and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative values of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, if palm kernel cake is offered locally at 57 per ton, then since its manurial value is 15s. per ton as shown above, the food value per ton is 25 6s. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 1s. 8d. Dividing this again by 23.4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 0.99d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculation a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own markets. The figures given in the table under the heading manurial value per ton are calculated on the basis of the following unit prices:—N, 8s. 1d.; P₂O₅, 2s. 11d.; K₂O, 8s. 2d.

at the same time produce practical results. It is undeniable that the dry period has a great effect on yield, and that the best is not made of it. We are almost in a position now to say what the general principle should be for the average cow, but that animal is so rare that it should be only found in a Zoo! With more fundamental knowledge of the subject, flexible rules could be laid down, that, if followed, would lead to a considerable increase in the yield per cow.

* * * * *

MISCELLANEOUS NOTES

PRICES of agricultural produce during October were on average 29 per cent. above those ruling in the base years, 1911-13, as compared with 42 per cent. a

The Agricultural month and a year earlier and 35 per cent. **Index Number** in August. The fall of 13 points in the index figure was occasioned primarily by the lower indices recorded for milk and hay, with fat cattle and potatoes contributing to a lesser degree.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1925 :—

Month				Percentage increase compared with the average of the corresponding month in 1911-13.					
				1925	1926	1927	1928	1929	1930
January	..	..	..	71	58	49	45	45	48
February	..	..	..	69	53	45	43	44	44
March	..	..	..	66	49	43	45	43	39
April	..	..	..	59	52	43	51	46	37
May	..	..	..	57	50	42	54	44	34
June	..	..	..	53	48	41	53	40	31
July	..	..	..	49	48	42	45	41	34
August	..	..	..	54	49	42	44	52	35
September	..	..	..	55	55	43	44	52	42
October	..	..	..	53	48	40	39	42	29
November	..	..	..	54	48	37	41	44	—
December	..	..	..	54	46	38	40	43	—

Grain.—Values for wheat receded further during the period under review, the average price falling by 4d. per cwt. to 6s. 11d. and the index number was 4 points lower at 7 per cent. below pre-war. Barley, however, showed a further substantial advance of about 1s. per cwt. and the index figure was 10 points higher on the month at 13 per cent. above 1911-13. In the case of oats, the rise of 2d. per cwt. was proportionate to that which occurred in the base years and the index was unaltered at 12 per cent. below pre-war. As

compared with a year ago, wheat was cheaper by about 2s. 6d. per cwt., barley by 8d. and oats by 1s. 8d., the index numbers being lower by 34, 8, and 24 points respectively.

Live Stock.—Quotations for fat cattle were rather lower than in September and the index figure fell by 4 points to 31 per cent. above the level of the base years. Values for fat sheep, however, were well maintained at an average of 62 per cent. in excess of pre-war. A further reduction occurred in bacon pig prices and the index number declined by 8 points to 25 per cent. above 1911-13. On the other hand, porkers showed a slight recovery over September and the index appreciated by one point to 45 per cent. above pre-war. Dairy cows were a little dearer on the month, but as the increase was proportionately less marked than in the base years, the index number was one point lower at 30 per cent. in excess of 1911-13. Store cattle also rose in price, but the index figure was unaltered. Although values for store sheep were fully 1s. per head above those recorded in September, the index number declined by 7 points, the rise between September and October of the base years being much more pronounced. Prices of store pigs fell away somewhat, but the index number was stationary at 107 per cent. above 1911-13. A year ago, store pigs were 95 per cent. dearer than pre-war.

Dairy and Poultry Produce.—Milk was a little cheaper on the month and this reduction, coupled with the effect of the rise from summer to winter prices that took place at the corresponding period of the base years, caused the October index to fall by as many as 53 points to 47 per cent. in excess of pre-war. A year ago the index fell by 52 points to 55 per cent. above 1911-13. Butter was further reduced in price to 14 per cent. above 1911-13. Values for cheese also moved downwards, the index number being 5 points lower at 17 per cent. above the base level. The seasonal advance in egg prices was again in evidence and the index figure rose by 20 points to 56 per cent. in excess of pre-war. At the corresponding period last year, the index for eggs appreciated by 24 points to 81 per cent. above 1911-13.

Other Commodities.—The index figure for potatoes fell by 11 points to 40 per cent. in excess of pre-war, whereas in October, 1929, values were at a much lower level, the index figure being only 17 per cent. above 1911-13. Both clover and meadow hay were about 10s. per ton cheaper on the month and the combined index for hay declined by 15 points to 4 per cent. below the base level. Although the hay index

has not infrequently fallen below pre-war during recent years, the latest figure is the lowest recorded in any month since the early part of 1915. The index number for fruit was unchanged at 6 per cent. and that for vegetables rather higher at 36 per cent. above 1911-13. Values for wool were further reduced to 12 per cent. below pre-war.

Index numbers of different commodities during recent months and in October, 1928 and 1929, are shown below :—

Percentage increase as compared with the average
prices ruling in the corresponding months of
1911-13.

Commodity	1928	1929	1930			
	Oct.	Oct.	July.	Aug.	Sept.	Oct.
Wheat	28	27	2	4	—3*	—7*
Barley	26	21	—12*	—12*	3	13
Oats	27	12	—20*	—13*	—12*	—12*
Fat cattle ..	31	31	30	37	35	31
„ sheep ..	52	55	66	62	62	62
Bacon pigs ..	26	50	40	41	33	25
Pork „ ..	33	64	49	50	44	45
Dairy cows ..	39	34	32	35	31	30
Store cattle ..	20	11	29	30	27	27
Store sheep ..	54	53	78	66	69	62
Store pigs ..	31	95	100	112	107	107
Eggs	66	81	44	40	36	56
Poultry	51	45	47	43	40	39
Milk	57	55	58	58	100	47
Butter	55	55	31	33	24	14
Cheese	78	37	32	28	22	17
Potatoes	51	17	23	25	51	40
Hay	6	40	18	15	11	—4*
Wool	70	42	—4*	—5*	—8*	—12*

* Decrease.

* * * * *

THE Revision Course in Cheese-making for Dairy Teachers, to which reference was made in the July, 1930, issue of this

JOURNAL, was held at Reading during the week ended September 27 last. Thirty-three teachers, including five demonstrators, attended the course, representing the following County Education Authorities or Educational Institutes :—

Berkshire, Carmarthen, Cheshire, Denbigh, Devon, Dorset, Durham, Essex, Glamorgan, Gloucestershire, Hertfordshire, Lancashire, Leicestershire, Monmouth, Nottinghamshire,

Somerset, Staffordshire, Suffolk (E), Sussex (E), Wiltshire, Worcestershire, British Dairy Institute, Chadacre Agricultural Institute, Leeds University, Midland Agricultural College, National Institute for Research in Dairying, Royal Agricultural College, Cirencester, Seale-Hayne Agricultural College, Studley College, Warwickshire.

The syllabus of the course comprised four morning sessions, devoted to demonstrations of the principal varieties of cheese, and three afternoon sessions for discussions on hard cheese, blue-veined cheese and soft cheese, respectively. The remaining afternoon was occupied by a visit to the National Institute for Research in Dairying, and the value of the course as a whole was generally acknowledged by the teachers in attendance. The discussions were productive of much useful information.

THE poultry industry is indebted to the World's Poultry Science Association for the inauguration of World's Poultry Congresses. This Association was estab-

**The World's
Poultry Science
Association**

lished in 1912 as the International Association of Poultry Instructors and Investigators, its objects being to facilitate in all ways the exchange and dissemination of knowledge pertaining to the poultry industry and to encourage scientific research and practical experimentation. In order to further the aims of the Association its official organ, *International Review of Poultry Science*, is published quarterly and circulated free to all members. This publication contains summaries of reports on educational and research work on poultry problems carried out throughout the world.

Particulars of membership of the Association may be obtained from the European Secretary, Dr. B. J. C. Te Hennepe, Rotterdam, Diergaardesingel 96a, Holland, or from the General Secretary, Dr. G. F. Heuser, Ithaca, New York, U.S.A.

THE Minister announces that for the purpose of the redemption of tithe rentcharge for which application is made after October 31, 1930, until further notice,

**Redemption of
Tithe Rentcharge**

the compensation for redemption will be 22½ times the net amount of the tithe rentcharge after the deductions prescribed by the Tithe Acts, 1918 to 1925, have been made.

Agricultural Congress and Exhibition at Angora, 1931.—A National Agricultural Congress will be held at Angora, Turkey, commencing January 1, 1931, under the auspices of the National Society for Economy and Thrift, an influential body whose President is also President of the Turkish National Assembly, and whose administrative council is composed of leading personages in the Republic. In conjunction with the Congress, an International Agricultural Exhibition, comprising, among other things, appliances, machinery, fertilizers and feeding stuffs, cattle medicine, etc., and methods of irrigation, has been arranged, the opening date of the Exhibition being fixed for January 5.

* * * * *

Agricultural Exhibition in Egypt, 1931.—The fourteenth Egyptian Agricultural Exhibition, which will take place at Gezirah, Cairo, next February, is being well supported by the Egyptian Government, a large section of the buildings now in course of construction having been taken over by the Ministry of Agriculture. The Palace of Industry has been enlarged by the addition of two new wings, and will be occupied by the Department of Commerce and Industry. The rapidity with which space in the section devoted to agricultural machinery is taken up by overseas manufacturers is no doubt due to the knowledge that imports of agricultural machinery and implements into Egypt have nearly trebled during the past three years. A handbook in English and French setting forth full details of the objects of the Exhibition and other information of interest can be obtained gratis on application to the Director, Royal Agricultural Society of Egypt, Post Office Box 63, Cairo.

* * * * *

Farm Workers' Minimum Wages.—A meeting of the Agricultural Wages Board was held on Tuesday, October 21, 1930, at 7 Whitehall Place, London, S.W.1, the Right Hon. Viscount Ullswater, G.C.B., presiding.

The Board considered notifications from Agricultural Wages Committees of decisions fixing minimum and overtime rates of wages and proceeded to make the following Orders carrying these decisions into effect.

Cambridgeshire and Isle of Ely.—An Order continuing from November 1, 1930, until October 31, 1931, the minimum and overtime rates of wages for male and female workers at present in force in the area. The minimum rates in the case of male workers of 21 years of age and over employed wholly or mainly as horsemen, cowmen or shepherds is 37s. per week of the hours necessary for the performance of the customary duties of workers so employed. In the case of other male workers of 21 years of age and over the minimum rate is 30s. per week of 40 hours in the week in which Christmas Day falls, 48 hours in any other week in winter, 42 in the week in which Good Friday falls and 50 hours in any other week in summer, with overtime at 9d. per hour on week-days and 11d. per hour on Sundays, Christmas Day and Good Friday. In the case of female workers of 18 years of age and over, the minimum rate is 5½d. per hour with overtime at 7d. per hour.

Cheshire.—An Order continuing the operation of the existing minimum and overtime rates of wages for male workers and minimum rates of wages for female workers from November 1, 1930, to May 1, 1931. The minimum rate in the case of male workers of 21 years of age and over is 35s. per week of 54 hours with overtime at 9d. per hour, and in the case of female workers of 18 years of age and over 6d. per hour for all time worked provided that in the case of such workers engaged for milking the wage shall

be not less than 6d. per "meal," i.e., each occasion on which a worker visits her place of employment for the purpose of milking.

Northamptonshire and Soke of Peterborough.—An Order continuing the operation of the existing minimum and overtime rates of wages for male and female workers from October 26, 1930, until October 24, 1931. The minimum rates in the case of male workers of 21 years of age and over is 30s. per week of 39½ hours in the week in which Christmas Day falls, 48 hours in any other week in winter, 41 hours in the weeks in which Easter Monday and Whit Monday fall, and 50 hours in any other week in summer with overtime at 9d. per hour on week-days and 11d. per hour on Sundays, Easter Monday, Whit Monday and Christmas Day. In the case of female workers of 18 years of age and over the minimum rate is 6d. per hour with overtime at 7½d. per hour on week-days and 9d. per hour on Sundays, Easter Monday, Whit Monday and Christmas Day.

Oxfordshire.—An Order continuing the operation of the existing minimum and overtime rates of wages for male and female workers from October 26, 1930, until October 31, 1931. The minimum rate in the case of male workers of 21 years of age and over is 30s. per week of 39½ hours in the week in which Christmas Day falls, 48 in any other week in winter, 41 hours in the weeks in which Easter Monday and Whit Monday fall and 50 hours in any other week in summer with overtime at 9d. per hour on weekdays and 11d. per hour on Sundays, Easter Monday, Whit Monday and Christmas Day. In the case of female workers of 15 years of age and over the minimum rate is 6d. per hour with overtime at 7½d. per hour on weekdays and 9d. per hour on Sundays, Easter Monday, Whit Monday and Christmas Day.

Warwickshire.—An Order continuing the operation of the existing minimum and overtime rates of wages for male and female workers from October 28, 1930, until October 27, 1931. The minimum rate in the case of male workers of 21 years of age and over is 30s. per week of 50 hours in summer and 48 hours in winter with overtime at 9d. per hour on weekdays and 11d. per hour on Sundays. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour with overtime at 6d. per hour on weekdays and 7½d. per hour on Sundays.

West Riding of Yorkshire.—An Order continuing the operation of the existing minimum and overtime rates of wages for male and female workers from November 24, 1930, until November 23, 1931. The minimum rates in the case of male workers who are boarded and lodged by their employer are:—foremen, 33s. per week or £85 16s. 0d. per annum; beastmen and shepherds, 32s. per week or £83 4s. 0d. per annum; waggoners, 30s. per week or £78 per annum, with lesser rates for lads. These rates being payable in each case in respect of a week of 48 hours in winter and 52½ hours in summer with in addition not more than 12 hours per week on weekdays and three hours on Sundays for work in connection with the care of and attention to stock. In the case of waggoners and other horsemen, beastmen and shepherds of 21 years of age and over who are not boarded and lodged by their employer the minimum rate is 42s. per week for the same number of hours as in the case of workers living in. The minimum rate for all classes of other male workers of 21 years of age and over is 36s. per week of 48 hours in winter and 52½ hours in summer. The overtime rates for all classes of male workers of 18 years of age and over are 11d. per hour on weekdays and 1s. 1d. per hour on Sundays. In the case of female workers of 18 years of age and

over the minimum rate is 6d. per hour with overtime at 7½d. per hour.

Carmarthenshire.—An Order continuing the operation of the existing minimum and overtime rates of wages for male and female workers from November 15, 1930, until November 14, 1931. The minimum rate in the case of male workers of 21 years of age and over is 31s. for a seven day week of 54 hours with overtime at 8½d. per hour. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour with overtime at 6d. per hour.

Copies of the Orders in full may be obtained on application to the Secretary of the Agricultural Wages Board.

* * * * *

Enforcement of Minimum Rates of Wages.—During the month ending November 14, legal proceedings were instituted against 17 employers for failure to pay the minimum rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases are as follows :—

County	Court	Fines			Costs			Arrears of wages		No. of workers involved
		£	s.	d.	£	s.	d.	£	s.	
Cumberland	Alston ..	—			2	8	6	1	6	1
Derby	Chapel-en-le- Frith	—			1	5	6	6	4	1
Devon	Holsworthy	1	0	0	—			17	4	1
Dorset	Weymouth ..	—			0	8	0	0	13	3
Durham	Bishop Auckland	—			0	13	0	8	6	1
"	Castle Eden	1	10	0	1	7	6	6	8	3
Huntingdon	Ramsey ..	0	10	0	—			†		1
Lancaster	St. Helens ..	4	0	0	1	19	0	17	0	2
Lincoln	Long Sutton	1	0	0	—			27	0	1
Holland										
"	Kesteven & Lindsey	*			—			8	16	1
N'umberland	Morpeth ..	1	0	0	0	8	0	2	9	1
Salop	Bishops Castle	—			0	9	6	16	0	1
"	Shrewsbury	5	0	0	—			4	17	2
Somerset	Temple Cloud	1	1	0	2	2	0	6	3	1
Yorks. W.R.	Tadcaster ..	—			—			—		1
Anglesey	Llanerchymedd	—			—			—		2
"	Menai ..	—			—			—		1
		£15	1	0	£11	1	0	£122	8	24

* Dismissed under Probation of Offenders Act.

† Amount of arrears to be agreed.

In addition to the above proceedings were taken at Worksop against an employer under Section 9 (3) (b) for refusing to give information to the Inspector and under Section 9 (3) (a) for molesting and a fine of 2s. 6d. was imposed in each case.

* * * * *

Foot-and-Mouth Disease.—An outbreak was confirmed on November 10 at Lockwood, Huddersfield, Yorkshire (West Riding), and the usual restrictions were applied to an area of approximately 15 miles radius round the infected premises.

Agricultural Cottages.—A Committee has been appointed by the Minister of Health and the Minister of Agriculture with the following terms of reference :—

To inquire into the conditions of occupation of agricultural cottages in England and Wales which are either let to or provided for agricultural workers in consequence of their employment. To report upon the present working of the special provisions of the Rent Restriction Acts relating to such cottages, and to make recommendations as to any alterations which may be desirable in the existing law.

This Committee has been constituted as follows :—

Mr. Walter Robert Smith, M.P. (chairman), Mr. David Black, Mr. George Dallas, M.P., Mr. H. H. George, M.C., Viscount Lymington, M.P., Mr. J. C. McGrath, Miss Picton-Turbervill, M.P. The Secretary of the Committee will be Mr. J. J. Maynard of the Ministry of Agriculture and Fisheries, 7 Whitehall Place, London, S.W. 1, to whom all communications on the subject should be addressed.

* * * * *

AGRICULTURAL RETURNS OF ENGLAND AND WALES, 1930

PRODUCE OF HOPS

PRELIMINARY STATEMENT showing the ESTIMATED TOTAL PRODUCTION of HOPS in the years 1930 and 1929, with the ACREAGE and ESTIMATED AVERAGE YIELD per STATUTE ACRE in each COUNTY of ENGLAND on which Hops were grown; and the AVERAGE YIELD per ACRE of the TEN YEARS 1920-1929.

Counties, etc.	Estimated total produce		Acreage returned on June 4		Estimated average yield per acre		
	1930	1929	1930	1929	1930	1929	Average of the ten yrs. 1920-29
	Cwt.	Cwt.	Acres	Acres	Cwt.	Cwt.	Cwt.
Kent { East ..	35,900	57,000	2,685	3,311	13·4	17·2	14·1
Mid ..	48,400	77,000	3,806	4,900	13·4	15·8	13·9
Weald ..	70,700	99,000	5,529	6,661	12·8	14·8	12·3
Total, Kent	155,000	233,000	11,820	14,872	13·1	15·7	13·3
Hants	6,800	17,000	867	1,012	7·9	16·7	11·8
Surrey	1,550	1,900	140	161	11·3	12·0	11·7
Sussex	22,800	36,000	1,680	2,139	13·4	16·8	12·3
Hereford ..	48,800	50,000	3,688	3,855	13·2	12·9	9·8
Worcester ..	17,300	20,000	1,732	1,818	10·0	11·2	9·8
Other Counties* ..	950	1,200	70	129	13·4	9·4	8·9
TOTAL ..	253,000	359,100	19,997	23,986	13·1	15·6	12·3

* Salop, Gloucester and Berkshire.

Note.—The acreage returned as under hops on June 4, 1930, was about 4,000 acres less than in 1929. In addition to this reduction there

was a considerably larger area than usual, estimated at about 3,500 acres, left unpicked. The total production of the 1930 crop from the area picked is estimated at 253,000 cwt. or 106,100 cwt. less than in 1929 and 49,000 cwt. below the average for the ten years 1920-1929. Calculated on the June 4 acreage, the average yield per acre for all the hop-growing counties was 13.1 cwt. as compared with 15 cwt. in 1929 and the ten years' average of 12.3 cwt., the yield per acre in each county except Hereford being lower than in the previous year. In view, however, of the unusually large area left unpicked this year, it should be noted that, as in previous years, the estimated total production does not include the produce which might have been obtained from the area left unpicked, but that the average yield per acre has been calculated on the acreage returned on June 4. In 1930 the area left unpicked was equivalent to over 17 per cent. of the acreage returned on June 4 and, if due allowance were made for this unpicked area, the average yield per acre would not compare unfavourably with that of 1929, the yield per acre in all counties except Hants, Sussex and Worcester, calculated on this basis, being equal to or above last year's average. In Kent, which produced about 60 per cent. of the total crop, the yield per acre, based on the June 4 acreage, was 13.1 cwt. compared with 15.7 cwt. in 1929 and 13.3 cwt. for the 10 years' average. The area left unpicked in Kent, however, was estimated at 2,600 acres, and if the yield were calculated over the picked area only, the average yield per acre would be 16.8 cwt.

The quality of the hops picked was on the whole good; although there was during the growing season a greater amount of downy mildew than usual, the inferior hops were in many areas left unpicked.

* * * * *

APPOINTMENTS

COUNTY AGRICULTURAL EDUCATION STAFFS :

ENGLAND

Cornwall : Mr. T. Dawson, B.Sc., Mr. J. H. Humphreys, M.Sc., and Mr. W. G. Sandercock, N.D.A., have been appointed Assistant Lecturers in Agriculture, *vice* Mr. B. Jenkins, B.Sc., Mr. A. B. Bates, B.Sc., N.D.A., and Mr. W. Williams, M.Sc. Mr. D. S. Cummins, N.D.A., replaces Mr. Sandercock as Temporary Assistant Lecturer in Agriculture.

Cumberland and Westmorland : Miss R. Taylor, N.D.D., C.D.P., has been appointed Manageress of the County Egg-Laying Trials, *vice* Miss W. Allison.

Durham : Miss W. Allison has been appointed Manageress of the County Egg-Laying Trials.

Essex : Miss M. E. Pirrie, B.Sc., has been appointed Assistant Lecturer in Agricultural Biology, *vice* Miss E. W. Jameson, N.D.H., appointed Assistant Lecturer in Horticulture and Fruit Preservation.

Lancashire : Mr. G. M. Robertson has been appointed Adviser in Poultry-keeping.

Nottinghamshire : Miss A. A. Shearman, N.D.D., C.D.D., has been appointed Assistant Instructress in Dairying.

Warwickshire : Mr. A. H. Wilson, N.D.A., N.D.D., has been appointed Assistant Agricultural Organizer, *vice* Mr. T. C. Goddard, B.Sc., N.D.D.

Wiltshire : Mr. L. D. C. McLees, B.Sc., N.D.A., N.D.D., has been appointed Assistant Agricultural Organizer, *vice* Mr. R. Wightman, B.Sc.

Mr. H. F. Burdett has been appointed Instructor in Poultry-keeping, *vice* Mr. L. C. Turnill.

WALES

Monmouthshire : Mr. F. R. Wallburton, Assistant Poultry Instructor, has resigned on being offered an appointment in Somerset.

Denbighshire : Mr. J. S. Roberts is temporarily undertaking the duties of General Science Instructor consequent on the resignation of Mr. J. H. Humphreys.

**PRINCIPAL WHOLE-TIME MEMBERS OF TEACHING STAFFS AT
UNIVERSITY DEPARTMENTS OF AGRICULTURE, AGRICULTURAL
COLLEGES, ETC., IN ENGLAND AND WALES**

School of Agriculture, University of Cambridge

Mr. H. H. Nicholson, M.A., has been appointed Lecturer in Agricultural chemistry.

The Horticultural College for Women, Swanley, Kent

The following appointments have been made since January 1, 1930 :—

Horticulture

Mr. R. Leo, Foreman of the Fruit Plantations.

Miss H. Smith, Dip. Hort., Foreman of Private Glass and Propagating Department and Rock Garden.

Miss K. Clark, N.D.H., Foreman of Pleasure Grounds and Playing Fields.

Agriculture and Dairying

Miss D. Postlethwaite, N.D.D., Head of Department and Lecturer.

Miss S. St. John, Dip. Hort., Assistant.

Poultry Husbandry

Miss M. L. Sinclair, Head of Department and Lecturer.

Laboratory Staff

Miss H. M. Farries, Ph.D., N.D.A., N.D.D., Lecturer in Plant Pathology and Zoology.

Miss F. C. Schimmer, B.Sc., Assistant.

Rural Home Management

Miss I. Paterson, Domestic Subjects Lecturer.

Miss F. Record, N.D.H., Instructor in Horticulture.

NOTICES OF BOOKS

British Poultry Husbandry : Its Evolution and History. By Sir Edward Brown, LL.D., F.L.S. Pp. viii+350. Illustrated. (London : Chapman & Hall, Ltd. 1930. Price 15s. net.)

The author of this work needs no introduction to the readers of this JOURNAL, but those who were interested in his article "Fifty Years of the Poultry Industry" in the issue for August last cannot fail to find this more elaborate and extensive history absorbing. Sir Edward himself warns readers that the book is not a text-book for the poultry keeper, but, as its title states, a record of the history of the "British Poultry Husbandry."

The period covered is from the very earliest time of which we have any knowledge to the present day, and the part played in the development of the modern bird by the sport of cock-fighting is clearly described. When Cæsar invaded Britain in 55 B.C. he found the inhabitants were keenly interested in this cruel sport in which they continued to be absorbed until it was prohibited in the middle of the nineteenth century. Naturally the breeders of fighting cocks desired to obtain certain qualities in their birds, and this led to what may be termed the first artificial selection. The meat value of the fowl was also early realized, and, every endeavour was made to improve the flesh-carrying capacity of the individual. Caponization

and cramming are both processes towards this end, and are of respectable antiquity.

In spite of the introduction of the turkey after America was discovered, and the trade between some districts with London in the eighteenth century--Norfolk and Suffolk for turkeys and geese, Aylesbury for ducks, Wokingham and Dorking for fowls—it was not till the nineteenth century that the production of poultry for sale really achieved large dimensions. It is only in the last 50 years that it has grown to be an integral and important part of farming economy. Sir Edward has described all the means by which the modern conditions have been arrived at, and his lifelong study of the subject has enabled him to do this as perhaps no one else could. The result is a valuable and interesting history of the industry which will, no doubt, remain for many years the standard work on the subject.

Management of Farm Poultry with a View to Profit. By Herbert Howes, with a Foreword by T. R. Robinson. Pp. xvi+180. Illustrated. (London: Chapman & Hall. 1930. Price 10s. 6d. net.)

The author of this book is the Assistant Director of the National Institute of Poultry Husbandry and was formerly head of the Poultry Department of the South-Eastern Agricultural College. He has designed his book for the use of practical men. As he says, there is still room for a large increase in our national production of poultry and eggs in spite of the rapid developments which have taken place in the past decade. He would like to see an improved class of stock kept in place of the nondescripts which still exist, and he shows how, by means of the varied educational influences that have now been at work for some time, this desirable end promises to be achieved in the future.

The book covers the whole range of the subject as fully as might be reasonably expected. It deals with the different systems of poultry keeping, houses and housing, selection of birds for egg production, foods and feeding, and the necessary seasonal work. The merits of natural and artificial incubation and rearing are discussed and chapters are devoted to table poultry production, selection and culling, diseases and their prevention, markets and the marketing of produce. Water fowl production is not overlooked, and a chapter on the breeding and rearing of turkeys is included.

The wide range of illustrations supplied cannot fail to be helpful in explaining such difficulties as may occur to the reader of the text.

Beef Cattle: Their Feeding and Management in the Corn Belt States.

By Roscoe R. Snapp, M.S. Second edition. Pp. viii + 494. Illustrated. (New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. 1930. Price 20s. net.)

The story of beef cattle raising in the United States, which forms the opening chapters of this book, is a modern romance, but while the industry has been modified in the course of its century of life, its conditions and necessities are obviously not directly parallel with those in this country. Different forage crops, none of them general or even well known in the British Isles, form the basis of feeding there: but the experience of the writer, who is the Associate Professor of Animal Husbandry in the University of Illinois, has some lessons which may perhaps be useful to the British grazier. Among these are some of the developments that have taken place in the five years that have passed between the issue of the first edition and the publication of this, the second and revised edition.

In addition to the history of grazing in the United States, the early chapters of the book contain a description of beef cattle raising in

the different countries of the world where it is practised, and some information about the methods of handling and the direction taken by the finished produce in these countries. The balance of the book covers the details of the industry from the farmer's point of view, and tells us how beef cattle are bred and cared for in the United States, and how, when they have been brought to maturity successfully, they are disposed of. The chapters on pregnancy, parturition and the care of young calves are practically universal in their application and are therefore of wide interest. Much of the rest of the book, as has been said, is hardly of direct practical bearing on the problems of British farmers, but could not fail, nevertheless, to form interesting reading for them, because some adaptation to British conditions might bring out ideas of profit and value.

Successful Canning and Preserving. By Ola Powell Malcolm. Fourth edition. Pp. xiv. + 663. Illustrated. (London : J. B. Lippincott & Co. Price 12s. 6d. net.)

This is the fourth edition of this manual, the author of which is the U.S. Department of Agriculture Field Agent for Home Demonstration Work in the Office of Co-operative Extension Work, and the book is designed to be a practical handbook for schools, clubs and home use. As the author says, the canning and preserving of food products is an important factor in household management and of even greater importance in national economy, since the conservation of foodstuffs, from the time of production and natural time of consumption to a later time, makes for a more varied and adequate diet, and that secured at a lower economic cost.

The book is a comprehensive treatise opening with a chapter on the history of the development of scientific canning, and going on to bacteriology as applied to canning. The necessary equipment is described and canning and bottling are discussed, as well as processing in hot-water baths and under steam pressure. The preparation of fruit juices, fruit, and vegetables for canning, preserves, the preservation of nuts and honey, jelly making, pickling and drying are all dealt with. The importance of fruit and vegetables in the diet is discussed, and the two final chapters touch upon curing and preserving meats and canning meat and sea food.

The conditions described and the apparatus recommended are, of course, American, but much of the book may be of service to those who propose to undertake canning and preserving in this country : there are indeed fairly lengthy quotations from Miss Watson in the pages dealing with jam-making in England.

The Dispersal of Plants throughout the World. By Henry N. Ridley, M.A., C.M.G., F.R.S., F.L.S. Illustrations by Miss M. B. Moss and the Author. Pp. xx+744. 22 plates, 1 coloured. (Ashford, Kent : L. Reeve & Co., Ltd., Lloyds Bank Buildings. 1930. Price 63s. net.)

The author of this work has set before himself the object of collecting and collating the large number of observations and records on the subject of the Dispersal of Plants that have been made from time to time for many years by different naturalists. These observations and records are scattered through the pages of a great variety of periodical and other publications, but there has so far been no adequate general work on the subject, which is all the more surprising when its very great importance is considered. A vast number of publications of all sorts has been consulted, only the most important of which are included in the bibliography, but this nevertheless fills ten closely printed pages.

The book does not attempt to give any account of the distribution, that is, the localization, or of the limits in area imposed by nature on

species of plants, as that belongs to a different subject. It treats only of the main cause of distribution of plants throughout the world, that is to say, *Dispersal*, as the title indicates. The various methods of dispersal are dealt with in the order in which they were evolved in the history of the world, viz., by Wind, Water, Animals and Man, including, at the end, various minor methods, such as explosive mechanisms and spread by creeping rhizomes, etc.

The work which the author set before himself has been well done, and the book is carefully illustrated. It will form a standard work of reference for all botanists for many years to come.

Teaching Agricultural Vocations : A Manual for teachers in preparation and in service. By Rolland Maclaren Stewart and Arthur Kendall Getman. Pp. viii+377. (New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. 1930. Price 15s. net.)

Very slight alterations have been made in the present second edition of this book, whose authors are respectively Professor of Rural Education at Cornell University and Specialist in Agricultural Education, New York State Department of Education. The title clearly indicates its object, but it may be added that the public the authors desired to reach are teachers in schools that we might call primary and secondary schools, although the American schools of the secondary grade are not strictly speaking precisely similar to ours.

Several books describing, incidentally to other matters, American methods of vocational teaching have already been noticed in this JOURNAL, and these methods can no longer be strange to the interested section of the British public; but the angle from which the subject has been approached in the books noticed has been that of effect upon the pupil. Here we have a study of the use and development of these methods by the teacher and a description of the aims of the methods in practice both from the teacher's and the pupil's point of view. The book is thus likely to be useful to those who are studying with the object of becoming teachers in agricultural schools and institutes, and indeed to those already engaged in this profession and interested in the theories underlying the system which has been found of value in the United States.

Each chapter is provided with a generous list of books, in the main, of course, American, for further study if that is desired.

Essentials in the Selection of Meat for Students of Home Economics.

By Viola M. Bell, B.S., M.A., and Maurice David Helser, B.S.A., M.S. Pp. xi+121. Illustrated. (New York: Wiley & Sons, Inc. London: Chapman & Hall, Ltd. 1930. Price 10s. net.)

In American high schools and colleges, the department of home economics is playing an increasingly important part in the scheme of education, and this will undoubtedly have a growing influence on the home life of the people and upon their demands upon those who supply their needs. This book is a good piece of evidence in support of these contentions, and is of a character that, with the exception of the less particularized information to be found in cookery books, is hardly likely to be paralleled at present in a British publication. Intelligent demand commands respect on the part of the supplier, and ultimately influences methods of production and systems of marketing. The assimilation of the information contained in the book will enable the meat buyer to understand the salesman's position and business, and thus to bring pressure to bear upon the trade to supply good quality and particular grades of goods, which will not be chosen in a haphazard manner easily turned away from its objective by the specious arguments known as good salesmanship.

Of the authors it is enough to say that the first named was formerly Associate Professor, Foods and Nutrition Department, and the second is Professor of Animal Husbandry at the Iowa State College, so that both the production and the buying ends of meat are fully represented. The book is divided into five chapters, the first of which deals with meat generally, in its structure, food value components and other such matters, and the others with Beef, Veal, Lamb and Mutton, and Pork, respectively. Each of these deals with market classes, grades, characteristics, dressing percentage and description of cuts, so that quite comprehensive detail is supplied, which cannot fail to meet the requirements of the classes of people for whom the book was designed, the foremost amongst whom may be designated in the American style "homemakers"; it is obvious also that it will be of interest to a number of other readers. It should be added that the book is very fully illustrated.

* * * * *

SELECTED CONTENTS OF PERIODICALS

Agriculture, General and Miscellaneous

The Relation of Science to Food Production: Wheat. *R. Ruggles Gate* (Quarterly Summary Roy. Bot. Soc. London, No. 45 (July, 1930), pp. 6-10.) [338.9; 37; 63.311.]

Emigration of Scottish Agricultural Workers. (Scot. Jour. Agric., xiii, 3 (July, 1930), pp. 307-310.) [325.2; 331 (41).]

The Weed Seed Population of Arable Soil. I.—Numerical Estimation of Viable Seeds and Observations on their Natural Dormancy. *W. E. Brenchley* and *K. Warrington*. (Jour. Ecol. xviii, 2 (Aug., 1930), pp. 235-272.) [63.259.]

The Biological Decomposition of Plant Materials. Part III. Physiological Studies of Some Cellulose-decomposing Fungi. *A. G. Norman*. (Ann. App. Biol., xvii, 3 (Aug., 1930), pp. 575-613.) [576.8.]

Economies

The Effect of Size and Shape of Fields on Costs and Profits. *R. McG. Carslaw*. (Jour. Yorks. Agric. Soc., 1930, pp. 92-98.) [338.1; 63.191.]

The Cost of Tractor Work on the Farm. *M. A. Knorr*. (Jour. S.E. Agric. Coll., Wye, No. 27 (1930), pp. 209-213.) [338.58; 63.175.]

Cost of Labour in German Agriculture. (Int. Lab. Rev., xxii, 1, 1930, pp. 81-84.) [331 (43); 338.58.]

The Scottish Potato Market. *D. W. Innes*. (Scot. Jour. Agric., xiii, 3 (July, 1930), pp. 235-242.) [63.512: 31; 63.512: 38.]

Problems in Co-operative Marketing of Turkeys. (Jour. Farm Econ., xii, 3 (July, 1930), pp. 469-471.) [334.6; 63.6: 38; 63.652.]

Research

A Method of Estimating the Yield of a Missing Plot in Field Experimental Work. *F. E. Allan* and *J. Wishart*. (Jour. Agric. Sci., xx, 3 (July, 1930), pp. 399-406.) [37 (01).]

Studies in Crop Variation, VIII. An Application of the Resistance Formula to Potato Data. *R. J. Kalamkar* (Jour. Agric. Sci., xx, 3 (July, 1930), pp. 440-454.) [37 (01); 63.3; 63.512-16.]

The Relationship between the Experimental and the Demonstration Plot and their Relative Value to the Investigator, the County Officer and the Fruit Grower. *T. N. Hoblyn*. (Ann. Rept., East Malling Res. Stn., 1929 (Part I, General), pp. 40-55.) [37 (01); 37:635; 63.41.]

Soils

- "Single Value" Soil Properties. A Study of the Significance of Certain Soil Constants. III.—Note on the Technique of the Keen-Raczkowski Box Experiment. *J. R. H. Coutts*. (Jour. Agric. Sci., xx, 3 (July, 1930), pp. 407-413.) [63.112.]
- "Single Value" Soil Properties. A Study of the Significance of Certain Soil Constants. IV.—A Further Note on the Technique of the "Box" Experiment. *B. A. Keen*. (Jour. Agric. Sci., xx, 3 (July, 1930), pp. 414-416.) [63.112.]
- Studies on the Carbon and Nitrogen Cycles in the Soil. I. Introductory. *H. J. Page*. (Jour. Agric. Sci., xx, 3 (July, 1930), pp. 455-459.) [63.113.]
- Studies on the Carbon and Nitrogen Cycles in the Soil. II.—The Extraction of the Organic Matter of the Soil with Alkali. *C. W. B. Arnold and H. J. Page*. (Jour. Agric. Sci., xx, 3 (July, 1930), pp. 460-477.) [63.113.]
- Studies on the Carbon and Nitrogen Cycles in the Soil. III.—The Formation of Natural Humic Matter. *M. M. S. du Toit and H. J. Page*. (Jour. Agric. Sci., xx, 3 (July, 1930), pp. 478-488.) [63.113.]
- Note on the Occurrence of Elementary Carbon in Soils. *G. W. Robinson and W. McLean*. (Jour. Agric. Sci., xx, 3 (July, 1930), pp. 345-347.) [63.113.]
- The Carbon-Nitrogen Ratio of Soil Organic Matter. *W. McLean*. (Jour. Agric. Sci., xx, 3 (July, 1930), pp. 348-354.) [63.113.]
- Note on the Determination of Exchangeable Sodium in Soils. *Rice Williams*. (Jour. Agric. Sci., xx, 3 (July, 1930), pp. 355-358.) [63.113.]
- Studies in Soil Cultivation. V.—Rotary Cultivation. *B. A. Keen* and the Staff of the Soil Physics Dept., *Rothamsted Experimental Station*. (Jour. Agric. Sci., xx, 3 (July, 1930), pp. 364-389.) [63.17; 63.19; 63.191.]
- Decomposition of Keratin by Soil Micro-Organisms. *H. L. Jensen*. (Jour. Agric. Sci., xx, 3 (July, 1930), pp. 390-398.) [63.115.]
- The Effect of a "Soil Mulch" on the Quantity of Water lost from a Given Soil by Evaporation. *E. S. West*. (Jour. Counc. Sci. Ind. Res. (Australia), iii, 2 (May, 1930), pp. 97-105.) [63.112; 63.13.]

Field Crops

- The Influence of One Crop on the Following Crop. *W. M. Findlay*. (Scot. Jour. Agr., xiii, 3 (July, 1930), pp. 293-299.) [63.191.]
- Manuring of Crops in Dumfries and Galloway. *J. Gillies*. (Trans. Highl. Agric. Soc. Scot., xlii, 1930, pp. 152-168.) [63.16.]
- Flax Production on a Factory System. I.—Introductory. *G. O. Searle*. (Report from the Linen Industry Research Association.) (Bull. Imp. Inst., xxviii, 2 (July, 1930), pp. 146-155.) [63.34111; 677.]
- Agricultural Meteorological Scheme. Precision Records on Wheat, 1928-30. *J. A. Rudderham and C. C. Webster*. (Jour. S.E. Agric. Coll., Wye, No. 27 (1930), pp. 216-219.) [551.5; 63.311.]
- Studies in Crop Variation. VII.—The Influence of Rainfall on the Yield of Barley at Rothamsted. Completed by *J. Wishart* from an Investigation initiated by *Winifred A. Mackenzie*. (Jour. Agric. Sci., xx, 3 (July, 1930), pp. 417-439.) [551.5; 63.3; 63.313.]

THE JOURNAL OF THE MINISTRY OF AGRICULTURE

Vol. XXXVII. No. 10.

JANUARY, 1931.

NOTES FOR THE MONTH

A CONFERENCE of Urban Allotment Authorities, convened by the Minister, was held at the Caxton Hall, Westminster, on November 18, when the proposals, contained in the Agricultural Land (Utilization) Bill, for encouraging the cultivation of allotment gardens by unemployed persons were explained and discussed. About 500 delegates from all parts of England and Wales, representing County, Borough and Urban District Councils, attended. Representatives of the Land Union, the Central Landowners' Association, the Chartered Surveyors' Institution and other bodies were also present. The Prime Minister presided at the opening.

The Prime Minister said that one of the great problems which confront this nation was the problem of how to return our people to the soil. There was a very large section of the industrial population who, like himself, had come from the soil and who, if they took a spade in their hands, would soon be able to recall arts that had been disused and that could be called into use and operation again. There had been one of the most extraordinarily interesting experiments carried on under the pressure of industrial distress in the Rhondda Valley. He was glad to see the great inspirer of that plan, Mr. John Robson, on the platform. After discussing some of the results of this work the Premier said that the Government had come definitely and enthusiastically to the conclusion that this work, extended by the beneficent assistance given by the Mansion House Fund, should become a national endeavour, organized through and with the assistance of public authorities. He was glad to say that they had prevailed on Sir William Waterlow, the late Lord Mayor of London, to consent to be Chairman of the voluntary organization it was proposed to set up to work in conjunction with the local authorities and the Government.

Mr. John Robson referred to the successful results achieved by voluntary effort in South Wales and elsewhere, and said that they had found that with co-operation, knowledge and education it was possible to make their potato patches into gardens of which they might be proud.

Dr. Addison, Minister of Agriculture, who took the Chair on the departure of the Prime Minister, said the matter was entirely non-party. They asked for the co-operation of all concerned. There was no time to be lost because it was important that land should be available so that men could get their planting started in the spring. They would try to plan the scheme so that it was not merely a flash in the pan, and to take advantage of the best experience available and to put the scheme on a permanent basis.

Lord Strachie, representing the Central Landowners' Association, and the Rt. Hon. E. G. Pretymann, representing the Land Union, spoke in support of the proposals. A number of questions were put and suggestions made by delegates, to which Mr. H. L. French, a Principal Assistant Secretary at the Ministry, replied.

Copies of the full report of the conference may be obtained, free of charge, from the Ministry's offices.

* * * * *

At the end of last Session, the Government introduced the Agricultural Marketing Bill for purposes of discussion. On

Thursday, December 18 last, the Minister
The Agricultural reintroduced the Bill in an amended form.

Marketing Bill Although the Bill has in no way been changed in principle, some of the amendments are of consequence.

A new clause has been introduced empowering the Minister to appoint one or more Reorganization Commissions which will have a dual function. The primary function of a Commission will be to examine existing methods and arrangements, and to prepare a detailed scheme for regulating the marketing of a particular product by the producers thereof; and the Minister will be required to take steps to further the consideration of the scheme by the producers concerned. The secondary duty of a Commission will be to investigate, if so required by the Minister, the relation of other interests (such as manufacturers or distributors) to any scheme with a view to securing their co-operation. This new clause should meet with the approval both of those who had misgivings as to the use which farmers would make of the Bill and of those who regard the solution of problems, such as the milk surplus,

as impracticable unless the manufacturing and distributive interests are consulted and participate.

Other amendments provide for the exemption of classes of sales as well as of classes of producers; for enabling a board to secure for its producers the business advantage of bulk purchase of agricultural requisites; and for increasing the usefulness of a board by permitting it to guarantee an agricultural charge (under the Agricultural Credits Act, 1928) when created by a registered producer.

Finally, fruit and eggs have been added to the list of products to which the Bill applies, the former at the request of English, and the latter of Scottish, producers.

(Copies of the Bill, in the form in which it has been introduced, may be obtained from H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2.)

* * * * *

A NEW publication recently issued by the Ministry is Bulletin No. 10 which deals with the important subject of Calf Rearing.

The object of the Bulletin is to give a brief account of those methods of calf rearing which have proved successful in different parts of the country. In matters of detail, there is a wide variation in the practice of different districts. These differences, however, depend mainly upon the extent to which whole milk or separated milk enters into the ration, the variation ranging from the unrestricted use of milk on the one hand to its practical exclusion on the other.

The particular method of rearing adopted depends largely upon the system of farming. In upland districts, where plenty of grass is available, in non-dairying districts generally, where the grass is of good quality and winter keep can be grown cheaply, and in every district where high-class pedigree dairy stock are reared, milk is fed liberally to the calf. On milk-selling and cheese-making farms, however, strict economy must be exercised in the matter. Butter-making farms occupy an intermediate position between these two extremes, because, although whole milk cannot be used freely, a plentiful supply of skimmed or separated milk, or butter-milk, is usually available for calf-rearing.

The Bulletin deals with the various phases of calf rearing; the construction and essential requirements of the calf house; the care of the new-born calf, suckling and hand-feeding; and the restricted and unrestricted use of whole milk. A dietary for the first six months of the calf's life should prove

useful to rearers. Copies of the Bulletin may be obtained from the Ministry, price 5d. net, post free.

* * * * *

ACCORDING to returns made to the Ministry by the beet sugar factories operating in Great Britain, the total quantity of home-grown beet sugar manufactured during November, 1930, together with the quantity produced during the corresponding month in

1929, was :—

November, 1930	..	..	..	..	2,419,700
November, 1929	..	..	..	..	2,050,965

The total quantities of sugar produced during the two manufacturing campaigns to the end of November were :—

1930-31	..	..	..	..	4,728,880
1929-30	..	..	..	..	3,519,478

* * * * *

A DETERRENT to the export trade in British cattle to tropical and sub-tropical countries is that overseas buyers realize the risk of importing susceptible animals when they are likely to come in contact with diseases which are prevalent in the importing country. It is well known that very serious losses have occurred—particularly from piroplasmosis and anaplasmosis—in British cattle imported by South African and South American countries.

Immunization against piroplasmosis and anaplasmosis can now be carried out at the Veterinary Laboratory of the Ministry of Agriculture and Fisheries, New Haw, Weybridge, Surrey, and stockowners desirous of having cattle immunized before export should apply for particulars of immunization and cost to the Director, Veterinary Laboratory, as above.

* * * * *

THE following note has been communicated by the National Institute of Agricultural Botany, Cambridge :—At the turn of the year thoughts of the spring sowings begin to occupy the farmer's mind. It is timely to insist on the importance of choosing the right variety. The difference in results between two varieties may be

as great as 20 per cent., yet it costs no more to grow good varieties than bad ones. Farmers would certainly often save money by leaving new varieties alone until it is known how

**Varieties of
Cereals for
Spring Sowing**

they have behaved in the trials carried out every year by agricultural institutes. The past season has again seen the introduction of new varieties, but the trials conducted at six centres by the National Institute of Agricultural Botany and the observation plots grown in co-operation with the Institute by many County Agricultural Organizers show that, though there are some varieties of promise at present under test, farmers in the Midlands and South of England cannot yet be safely recommended to grow other varieties than those of which brief particulars are given below.

Spring Wheat.—This is not often a profitable crop. Of the available varieties the weak-strawed APRIL BEARDED is quickest to ripen, but RED MARVEL and A1 are the most generally useful.

Spring Barley.—PLUMAGE-ARCHER on the most fertile soils, SPRATT-ARCHER where fertility is low, or either in other ordinary circumstances should be the choice of the farmer who wants a good crop of malting barley. For very late sowing the early-ripening VICTORY is worth consideration.

Spring Oats.—VICTORY is the most generally profitable variety and GOLDEN RAIN is as good when the crop is to be consumed on the farm. ABUNDANCE combines the highest quality with adaptability to a wide range of soils, but THOUSAND DOLLAR should be preferred where farming is high. MARVELOUS stands well even on very rich soil and, sown early, yields heavy though coarse-grained crops.

Farmers who want further information about these or other varieties can obtain it either from their County Agricultural Organizer or from the National Institute of Agricultural Botany, Cambridge.

* * * * *

THE College of Estate Management has printed for private circulation the first of a series of agricultural monographs.

Systems of Dairy Farming

These monographs will be reports presented by scholarship holders who have been enabled to travel in this country and abroad by means of the travelling scholarship awarded by the College. The present volume deals with systems of dairy farming and is the report of Mr. W. E. Cole, who was the first scholar appointed by the College, and held the scholarship for two consecutive years.

Mr. Cole presents an interesting and extensive survey of systems of dairy farming in many countries, which forms an important addition to knowledge on this subject. During the

holding of the scholarship, some 172 dairy farms were visited in Great Britain, accounts in respect of 108 of which were available, and in 63 cases data from complete cost accounts were willingly disclosed. The districts covered included every English county except Cornwall (from lack of time), 21 Scottish counties and several in Wales. About twelve months of the period were spent in the British Isles, and the remaining twelve months in various other parts of Europe, including Denmark, Sweden, Norway Belgium, Holland, France, Switzerland, Italy and Austria.

This scholarship should prove a valuable supplement to existing scholarship schemes. It is awarded annually and is of the value of £300. Any inquiries in connexion with this Report or the Scholarship should be addressed to the Secretary of the College, 35 Lincoln's Inn Fields, London, W.C. 2.

* * * * *

To the grower of potatoes, the purity of his crop is a matter of considerable importance. A badly mixed crop—a most unsatisfactory result in any case—may

Seed Potato lead to financial loss and it is very
Certification desirable, therefore, that precautions
should be taken to ensure that potatoes

obtained for planting are true to type. Under the Seeds Act and Regulations it is illegal to sell seed potatoes as being of any specific variety if they contain rogues to the extent of more than 3 per cent. An even higher standard of purity is required by the Ministry's inspection and certification scheme under which the minimum standard of purity is 99.5 per cent. Growers would be well advised when placing orders for "seed" potatoes to stipulate that the tubers must be supplied from a stock which is the subject of one of these purity certificates.

A register has just been issued giving particulars of the crops certified by the Ministry's Inspectors during the past season. Copies of this register can be obtained from the Ministry at 10 Whitehall Place, London, S.W. 1, price 1s.

Growers are reminded that under the Wart Disease of Potatoes Order of 1923, the only potatoes that may be planted in land on which Wart Disease has occurred at any time are potatoes of approved immune varieties that have been inspected whilst growing and certified as true to type and reasonably free from rogues, or potatoes of approved immune varieties saved from crops grown on the land in the previous

year. The Order further provides that on the sale of any potatoes for planting the seller must furnish the buyer with a written statement identifying the relative certificate (*e.g.*, by quoting the certificate number). In the case of potatoes of approved immune varieties, the certificate number to be quoted is that given in the register referred to above, but in the case of other varieties the number to be quoted is that of the relative "Clean Land" certificate issued to the grower concerned, and not that of the purity certificate quoted in the register. Growers who desire to sell potatoes of the 1930 crop for planting should now apply to the Ministry for a "Clean Land" certificate in respect of their premises, if they have not already done so.

THE following note has been communicated by Dr. Thomas Milburn, Principal of the Midland Agricultural College, Sutton Bonington, Loughborough :—

**Farm Drainage
Records**

Many farmers now keep milk records and many poultry keepers record egg production by means of trap nests, but the importance of keeping proper records of the drains on a farm has not yet received the recognition that it deserves. Estate agents frequently omit to provide a plan setting out all the drains in detail. The landlord may supply the pipes to his tenant, who will lay a length as occasion demands, neither owner nor occupier keeping a proper record of their position on the farm. Such drains are often laid alongside or across existing pipes, the result being a tantalizing network running in all directions. Having no better guide than the memory of an old labourer or local resident, each newcomer makes "confusion worse confounded," while time and money are wasted in searching for unrecorded drains. Of late years the necessity for recording drains has assumed increased importance owing to the break-up of estates.

The process of tracing an unrecorded drain from a ditch by means of trial holes dug at intervals is tedious and involves considerable labour, especially as the old drains seldom run straight and many outlets have disappeared owing to the neglect of water courses. When several fields are merged into one, a drain may be laid at the bottom of a winding ditch before the latter is filled. It frequently happens that the drains entering such a ditch are not properly connected with the new drain, and to trace their courses may be no easy matter. The

cost of new pipes is high, and if an old drain can be made effective so much the better. In the absence of a detailed survey, a sketch map showing the direction of drains, indicating junctions and outlets, and giving distances from some well-defined object, will serve a useful purpose and effect considerable saving in time, labour and expense.

* * * * * *

THE importance of good and early grazing—obtained by the proper use of artificial fertilizers on suitable fields—has been emphasized in recent years by the findings of scientists that young grass is of nearly as high a feeding value as linseed cake. The mowing of young grass, when cattle or sheep are not available to eat it, and its storage in blocks as “grass cake,” has been attempted, but this does not seem to be, as yet, an economic reality.

**Economical
Feeding of
Stock**

Leafy herbage, however, mown early—or grazed first, then cut late and turned into hay—makes a good substitute for young grass or grass cake. Such hay may not contain so much protein per cent. as very young grass, but, as there is more of it, the hay, per acre, will contain a great deal more protein. Fed to stock with roots or kale, it will provide for a fair milk yield.

It is probably unwise to allow unlimited hay of ordinary quality to be fed to the heavier milking cows. It is, indeed, possible that the diminished milk yields known at this season may be due, in part, to cows being allowed to gorge themselves with hay, particularly of the poor qualities that farmers are accustomed to utilize first. Good hay, however, in moderation, with roots or kale, will produce a reasonable yield; and the question for the farmer is whether to maintain his quantity of milk by the intensive feeding of fewer cows, or to get it from a larger number fed less liberally.

There is no likelihood of a general shortage of milk this winter—it is rather the other way; and until the milk industry becomes more fully organized in the interests of farmers it seems unwise to produce a surplus to ordinary requirements. What can be done by way of organization in cheesemaking and marketing is indicated in the recently-issued Report of the Ministry on the Marketing of Cheese—a book which every dairy farmer should possess; and he can obtain it for the trifling expenditure of 9d., on receipt of which a copy will be sent by H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2.

ECONOMIC ASPECTS OF PIG RECORDING

A. W. MENZIES KITCHIN, M.A., B.Sc.(Agric.),
School of Agriculture, Cambridge.

ALTHOUGH recent research in animal nutrition has removed many of the problems of pig-keeping, there still remains a wide field for investigation. During the past few years much attention has been paid to swine dietetics; the suitability of different feeds—protein and carbohydrate—has been examined and catalogued; an extensive literature has grown up around vitamins and minerals; while the subject has been approached from the fundamental side in the laboratory and from the practical side in large-scale feeding experiments at research stations and agricultural institutes. The results of these experiments have placed at the disposal of the farmer a mass of valuable data, the intelligent application of which can greatly reduce his feeding costs. Unfortunately, the problem does not end when the nutritional aspect is solved, and the importance of factors other than feeding, viz., small details of management, the personal touch in a good pigman, alternative types of housing, marketing, the breed and strain of the animals used, are becoming generally recognized. The full benefit of the improvement in feeding, therefore, can only be obtained when herd idiosyncrasies due to the above factors have been corrected. For this reason the scope of the problem tends to turn to breeding and management, but the general aim remains the same—to make pig-breeding pay. In any industry increased profit may be obtained:—

- (1) By an increase in selling price when the cost of production remains the same;
- (2) By a decrease in the cost of production when the selling price is constant; or
- (3) By a combination of both these factors.

In a period of high prices the inefficient farmer may conduct business at a profit, but in the present depressed state of agriculture the margin of profit can be most readily increased by considered reductions in the costs of production. At this point, therefore, it becomes necessary to set up machinery capable of reviewing the industry as a whole, and of ascertaining the effect of the several factors in production on the cost of the commodity produced. This can be conveniently carried out by a system of survey.

As trap-nesting and milk recording evaluate the efficiency of the hen and the cow, so pig recording helps the farmer to assess (1) his efficiency as a producer of pig meat, and (2) the efficiency of his sow; this places him in a position to remove the unprofitable units from his herd and to select breeding

stock from strains that have proved prolific and efficient converters of food into flesh.

The various types of pig recording employed in England and elsewhere have been described in detail in the November, 1929, issue of this JOURNAL and in the three Reports of the East Anglian Pig Recording Scheme* already published. The objects of the scheme are summarized as follows :—

- (1) To measure and compare the economic capacity of the individual sows and boars in a farmer's herd.
- (2) To help the farmer to locate where and how his herd and his management are succeeding or failing in pig production.
- (3) To enable the farmer to compare the average yearly results of his own herd with previous years, or with the results of other herds for the same or previous years.
- (4) To supply a rational basis for the sale of breeding stock and for utility classes at livestock shows in the same way as milk records are employed in the sale and judging of dairy cattle.
- (5) To collect reliable data on a large scale suitable for detailed and scientific analysis by trained investigators. From these results suitable standards of production could be compiled and light could be thrown on many problems that cannot be easily or economically investigated by ordinary experimental methods. Such records would also form a basis for comparing the efficiency of the British producer with that of his chief competitors.

Pig Recording in East Anglia.—Pig recording in England originated in East Anglia in 1927, the object being to determine a scheme of recording suited to English conditions. The first 18 months were spent getting together a body of interested farmers and in perfecting details of administration. At the outset it was hoped that all pigs of which the pre-weaning records were obtained would be disposed of through one or other of the bacon factories acting as slaughter centres, but it was found that members were unwilling to agree to any specific method or place of marketing, and certain adjustments had to be made to allow economic freedom of disposal. Live weights on the farm, dead weights returned from the pork butcher and weights on railing are now accepted in place of weights taken at the factory; factory weighings, however, are still considered ideal.

The present scheme, based on two years' experience, was introduced in October, 1929. The method of operation is briefly outlined below :—

- (1) Each member is provided with a diary in which he is required to enter :—
 - (a) The date of farrowing; the number of piglings born; the breed of sow and boar used; and details of subsequent deaths, of all farrows in the herd.

* Copies of each of the three reports can be obtained on application to the Organizer, Department of Agriculture, University of Cambridge, price 1s. 2d. per copy, post free.

- (b) All sales of recorded animals with, where possible, live weight at disposal, except in the case of factory disposals where live weight is taken at the factory; all deaths due to accident or disease; and particulars as to alterations in feeding and practice.

Members who also take part in the feed consumption sub-scheme enter all details as to the type and quantities of the various pig meals consumed on the farm and weights of all pigs leaving the farm—whether recorded or not.

- (2) A recorder visits the farm at maximum fortnightly and minimum monthly intervals when he—

- (a) extracts relevant information from the diary;
- (b) weighs and earmarks with a distinctive earmark all young pigs on the farm within the age range of three to seven weeks;
- (c) earmarks younger litters if they are likely to be mixed before his next visit; and
- (d) notes before leaving the farm the date on which the next visit will be made.

- (3) When a litter is completely disposed of, or alternatively when the pigs are 15 months of age, a final litter record is issued to the farmer. This record gives a detailed account of the pre- and post-weaning performance of the litter in question.

During the year ending March, 1930, 217 final litter records were issued for litters completely disposed of or otherwise accounted for. The averaged results of complete litters passing through the factory are given in the left-hand column below. Pig-recording standards are set down for reference in the right-hand column:—

		<i>Recording standards</i>
Number of pigs born alive ..	9.9	10
Number of pigs at six weeks ..	8.4	8
Average weight at six weeks ..	19.1 lb.	21 lb.
Total litter weight at six weeks ..	160.8 lb.	168 lb.
Average weight of pigs at slaughter	208.8 lb.	200 lb.
Average dead weight of pigs ..	161.4 lb.	150 lb.
Average curing weight of pigs ..	131.2 lb.	120 lb.
Number of pigs recorded at slaughter	6.7	—
Average loss from live weight/dead weight	22.7 per cent.	25 per cent.
Average loss from dead weight/curing weight	18.7 per cent.	20 per cent.
Average age in days at slaughter	255.0	—
Average age in days at which pigs should have reached above weight	201.1	194
Average number of days wasted ..	53.9	—
Average extra cost of production for pigs at 3½d. per day ..	15s. 9d.	—
Good quality bacon carcasses ..	38.6 per cent.	—

Differences in Herd Efficiency.—Efficiency in pig production is largely controlled by:—

- (1) The number of pigs born and marketed per litter; and
- (2) The economy of feed consumption per lb. live weight gain,

(1) is a simple numerical estimation; and, as rate of growth is closely connected with economy of feed conversion, (2) can be conveniently estimated by comparing the time required to reach a given weight with the standard age for that weight. These two factors are used as a basis for comparing results.

During the past year it was found that the highest average number of pigs born alive in any litter was 13.5, while the lowest was 8.1. At six weeks, the first herd returned a litter average of 11.3 and the second 6.5 pigs. "As upkeep of the sow during the period of gestation and suckling has to be distributed between the pigs reared, this difference of nearly 5 pigs per litter is extremely significant. From data obtained at the Rowett Research Institute, Aberdeen, it has been calculated that the cost of weaning a litter of pigs is in the neighbourhood of £10. If this figure is correct then the difference in initial cost between litters of 10 and 5 pigs is roughly £1 per pig, or, in other words, the pig from a litter of 10 starts life with a credit of £1." (Third Report.)

On the same basis the difference in initial weaning cost per pig between the best and worst herd was 13s. As regards feeding, the worst herd required 112 days above the standard number to reach bacon weight, and, as it may be assumed that rate of growth is closely correlated with economy of feed conversion, it can be estimated that this difference in the cost of production was in the neighbourhood of 32s. 8d. per bacon pig. "It has been shown that for purposes of maintenance and movement, pigs of 100, 150 and 200 lb. live weight require 2.9, 3.3 and 3.6 lb. of meal per day. If the average figure required for maintenance during this period is taken at 3.2 lb. and the average cost of meal at 1½d. per lb., it may be assumed that every day spent on the farm above the standard number costs the farmer 3½d." (Third Report.)

Management.—The percentage of pigs born that are alive at six weeks gives an excellent indication of the management in any herd. In the best herd, 94.2 per cent. of the pigs born were alive at six weeks old, while in the worst herd only 62.7 per cent. remained. Pre-weaning mortality could often be avoided by a little forethought on the part of the farmer. When long straw is used as litter, young pigs are frequently overlaid. This involves unnecessary loss, and in certain herds the mortality percentage has been reduced by the use of chopped straw. Scour, overcrowding, lack of minerals, over-fed sows, uncomfortable housing, damp, draughts and unsympathetic pigmen are further causes of deaths, while for no apparent reason it is impossible to rear pigs successfully in

certain types of "model" piggeries. Lack of success in feeding was for the most part due to overcrowding, ill-balanced rations deficient in protein and minerals, the substitution of good home-grown feeds by cheap feeds of doubtful value, uncomfortable quarters, and worms.

Where pigs are running in yards, it is difficult, under the survey method, to assess the importance of the last-named factor, but it is interesting to note the following passage contained in the First Report of the Edinburgh Testing Station :—

"Worm infection is much more prevalent and caused much greater loss than is generally believed to be the case. We are of opinion that official steps should be taken to inform pig breeders and feeders how to keep their herds free of worms." This agrees with the general opinion in East Anglia.

Quality.—Of the carcasses examined during the year, 38·6 per cent. were graded as suitable for the production of first quality bacon. The average age of "Prime" carcasses was 265 days, or 12 and 20 days older than carcasses placed in the "Medium" and "Stout" grades. In the herd returning the lowest economy of gain, 76 per cent. of the carcasses were graded as "Prime." These results seem to confirm the opinion previously held that the worst quality pigs mature earliest. The lowest number of "Prime" carcasses in any herd was 5 per cent. Over 50 per cent. of the carcasses between 7 and 8 score were placed in the first grade. In carcasses of 8 to 9 score the percentage had fallen to 30. This result emphasizes the value of a weighing machine on the farm and it is certain that the labour entailed in monthly weighings of store and fattening stock would be more than repaid by the extra 6d. per score received at the bacon factory for pigs within the 7 to 9 score range. The uncertainty of the estimated weights on the farm is well illustrated by two litters (15 pigs) recently sent to the factory as baconers (approximately 200 lb.) which returned an average live weight of 249 lb. at the factory and were totally unsuited for the Wiltshire trade.

The Imperial Economic Committee, in the Report on "Pig Products," stress the necessity for the production of a uniform pig and for the co-operation of the farmer and curer to that end. Although the question of payment for quality is extremely controversial it is submitted that the uniformity desired could be obtained more quickly if the present flat rate method of payment were replaced by a system extending a bonus for

first quality pigs. Payment on the present basis offers no stimulus to the farmer who produces prime pigs, and may often act in the opposite direction, as cases have been met where a heavy-shouldered boar was used with the idea of producing heavy rapid-growing pigs of good constitution.

Breeding.—Large White Boars and Large Black Sows were the most popular sires and dams. Sows' pigs were slightly larger and heavier than those of gilts, but gilts appeared to be the better mothers, probably owing to the fact that with increasing age and weight the sow was more likely to crush the young pigs. Sows can be bred successfully up to eight or nine litters. A greater variation in live weight at six weeks old occurred in litters of cross breeds than in those of pure breeds. Little difference was evident in the litter average throughout the year, but pre-weaning mortality was highest during the winter months. When rib counts were taken at the factory, it was shown that the number of rib pairs was positively correlated with length of side.

Feed Consumption Scheme.—It has been shown that feeding stuffs represent 80 to 90 per cent. of the total pig-keeping costs, the remaining percentage accounting for rent, labour and incidentals. Further, as rent and labour varies but slightly between districts, this balance of 10 to 20 per cent. is fairly constant. Differences in costs of production are therefore largely accounted for by the efficiency of feeding, *i.e.*, by the amount of meal required to produce 1 lb. of pork, live or dead weight. Any measure by which feed consumed can be translated into pork produced gives an excellent idea of the value of the management in a particular herd. The general aim of the feed consumption scheme is therefore to measure the weight of pork produced by a given quantity of meal in one year. The scheme operates as follows :—

- (a) All suckling, weaning and fattening stock in the herd are weighed at the beginning and end of the year under review ;
- (b) A record is kept of all quantities of mixed meal consumed during the year ;
- (c) Weights are obtained of all purchases and disposals during the year ;
- (d) It is then possible to calculate the weight of pork produced during the year and to offset it against meal consumed.

By the above method the breeding stock is treated as the machinery of production, and their share of the feed is charged against the pigs marketed. During the past year, records of feed consumption have been completed in two herds ; the main points of the investigation are given below :—

(1) Lb. of meal per lb. saleable live pig meat produced =	4.62 lb.		
	£	s.	d.
(2) Net average cost of mixed meal (per ton) ..	11	0	10
(3) Average price per score dead weight received per pig marketed		0	18 4
(4) Average price per pig marketed		7	9 5
(5) Average cost of food consumed per pig		4	14 5
(6) Average cash returned per pig over food consumed		2	15 0

"As feed-consumption records were kept for the above herd during 1928-29 it is possible to compare the present figures with those of the previous year. The main feature of the comparison is the increase from 3.97 to 4.62 lb. in the meal required to produce 1 lb. live weight per pig, an increase of .65 lb. per lb. gain. On a 204 lb. pig—the average live weight at the factory of all pigs marketed from this herd—this represents an additional consumption during life of 1 cwt. 20 lb. of meal per pig, or a cash difference (calculated from the average price of the meal) of 12s. 11½d. During the year under review a decrease in the price of pig feeds reduced the average meal cost for the year by 1s. 6d. per cwt., and any advantage that might have been derived from this reduction was negated by the extra amount of meal required in feeding. It is therefore evident that the increase of 29s. during the present year in the net return per pig is due to an advance of 3s. 7d. in the average price per score obtained at the factory." (Third Report.)

In the second herd, no breeding stock was kept. The pigs were bought in as weaners at £1 18s. 8d.; 3.9 lb. of meal were required to produce 1 lb. live weight of pork; and the average return per pig, after deducting the cost of meal and pig, was £1 11s. 2d.

Utility Pig Classes.—The application of recorded information to utility classes at livestock shows is a natural growth in the development of pig recording. At the London Dairy Show (1930) an attempt was therefore made to demonstrate the practical value of a class for recorded bacon pigs. The objects of the class may be briefly summarized as follows:—

- (1) To provide a class for bacon pigs in which the requirements of farmer and curer are equally represented;
- (2) To lay down definite standards of performance to facilitate comparison of results from year to year;
- (3) To ensure that the class should be a litter test and that the litter should be adequately represented;
- (4) To credit the sow with the performance of the litter—for advanced registration.

Moreover, to meet the further objection to present-day conditions, viz., that the difference in the value of prizes

awarded is often excessive in view of the narrow margin of points separating the exhibits, a new method of assessment was introduced in which equal money awards were given to all exhibits reaching certain standards of production. The arrangement of the class was as follows :—

Six pigs from the litter of a recorded sow formed an exhibit. These pigs were recorded by an official of the East Anglian Pig Recording Scheme in the ordinary way. After weaning they were fattened on the farm and on September 18 were sent to Messrs. Harris's Bacon Factory, Ipswich, where they were weighed and slaughtered, various carcass measurements being obtained. The carcasses were subsequently cured as Wiltshire bacon, and four sides—one hog and one gilt—were sent for exhibition at the London Dairy Show. Awards, however, were made on the performance of the six pigs sent to Ipswich. These were assessed :—

- (1) As to pre-weaning results (*i.e.*, number weaned, average weight at six weeks and litter variation) ;
- (2) Rate of growth ;
- (3) Quality.

Standards of performance based on records obtained during the past three years were laid down, and, after certain allowances had been made, the exhibits were graded as "Superior," "Standard" or "Inferior" as they agreed with these standards. First and Second Class awards were then given to all exhibits of "Superior" and "Standard" performances respectively.

Seven groups of six pigs were entered for competition, and three were assessed as "Superior," one as "Standard" and three as "Inferior." The "Inferior" exhibits were lacking in quality and were faulted on account of deficient length and too thick back fat, although it may be noted that one of these exhibits returned the best growth result for any group. The number of pigs weaned varied from 8 in the worst litter to 12 in the best. On the previous assumption that the cost of weaning a litter of pigs is in the neighbourhood of £10 this represents a difference of 8s. 4d. per pig in weaning cost. The highest average weight at six weeks old was 27½ lb., the lowest 19½ lb. The index used to measure the growth rate varied from 99 to 109 or, in other words, the litter with the highest index reached bacon weight 20 days ahead of the other, while the farmer saved 5s. 10d. per pig in cost of feed.

The above class is an attempt to bring together the interests of producer and manufacturer in a workable plan of assessment capable of application to pig classes throughout the country. It further attempts to emphasize that the

prosperity of the pig-keeper and bacon curer in this country are inter-dependent. Neither is a philanthropist, and each must receive a reasonable profit on the capital invested in his enterprise. Although the farmer is mainly concerned in marketing his pigs at a profit, he must realize that the success of his industry will be measured by the extent to which he supplies the curer with animals of suitable quality and type. On the other hand, although mainly interested in type and quality, the curer must consider that his prosperity is linked up with the prosperity of the farmer, and that unprofitable conditions in pig-keeping must react adversely on the bacon-curing industry.

Future Development.—The wide variation of results in the sample of herds recorded during the past three years clearly indicates the necessity and scope for pig recording in England. Further, the growth of the scheme from 23 to 70 members during the last six months of 1929 is a testimony to the growing popularity of the movement.

Recording forms an intimate link between the research worker and the practical farmer. In his periodic visits to the farm the recorder has an excellent opportunity of observing faults in practice that might otherwise pass unnoticed. It is not sufficient, however, that he should be able to point these out to the farmer; he must be in a position to advise him how to cope with his problems as they arise. It is therefore essential that any system of recording should be linked up with a strong advisory service capable of dealing with problems of management, feeding and disease.

Further, the establishment of testing stations at suitable intervals, working in co-operation with the survey system and to which sample groups of typical litters from recorded herds could be sent in order that differences due to the farmer's feeding and management could be eliminated, and a measure obtained of differences in breed and strain, would provide the farmer with a pig-recording and intelligence service capable of raising the general level of production, would reduce costs and place his industry on a more equal footing with those of his Continental competitors.

ANIMAL HEAT

By Professor Sir J. ARTHUR THOMSON, M.A., LL.D.,
*Emeritus Professor of Natural History in the University of
Aberdeen.*

EVERYONE knows the pleasant warmth of a cow's neck—one of the best examples of animal heat. What a contrast when we take away our hand and pick up a frog, so cold and clammy. On a frosty morning we see the hot water-vapour from our lungs condensing into a little cloud in the cold air. Our fingers may become so numb that we are glad to put our hands in our pockets so as to be nearer the warmth of our body. We are familiar with the value of non-conducting woollen clothing in lessening our loss of heat, and in making it possible to have a sort of perpetual summer between our own skin and that of the animal from whose pelt we more or less have borrowed.

Some may have noticed the steam rising from a slaughtered sheep, or from a skinned rabbit, or even from a torn grouse left by the startled eagle—the warmed water-vapour passing into the cool air is condensed and becomes visible. Similarly from the sweating, over-driven horse warmed water-vapour steals off into the summer air, and this evaporation automatically cools the skin. On the hot day we see the panting dog with its long tongue lolling out. It is not sweating by its tongue, as some people think; it is allowing the salivary juice to evaporate, and this change from fluid to vaporous form uses up heat, the result being that the surface of the tongue is cooled, reducing the temperature of the adjacent blood, and reacting a little on the general circulation. These instances must serve to illustrate what is meant by animal heat, or the warmth produced by the living body. *What is its origin?*

Production of Animal Heat.—It is a little difficult for us to realize that “animal heat” was an enigma until the work of Lavoisier, who was guillotined by the revolutionaries in 1794. Lavoisier was the first to discern clearly that the heat given off by living creatures is the result of the union of oxygen with combustible material, just as in a burning fire. He placed the panting mouse beside the burning candle, and demonstrated that both are undergoing oxidation, each in its own way. Henceforth the “burning bush” of old became with a new meaning a symbol of the living creature, which is always burning and yet is not consumed—till the fire is eventually put out.

The foundation-fact is that heat is produced by oxidations that go on in the ordinary chemical routine of the body. It is produced in all breaking-down or katabolic changes, but by far the most of it is produced by the muscles, especially when they are contracting. We have only to think for a moment to feel sure that heat is produced even when the muscles are at rest. For during sleep, most of the muscles, except those concerned in the beating of the heart and the breathing movements, are having a rest, and yet they are producing much heat. If it were not so, we should soon waken with cold, even with the best of blankets. The heat-producing (or thermogenic) function of the muscles continues even when they are in a state of relative rest. One must not forget that some other organs add to the heat which the muscles produce, and the best illustration is the liver. One has only to dissect or open a rabbit, soon after it has been killed, to feel the warmth of the liver, and one may also be able to demonstrate that heat is produced by the digestion of the food in the stomach and small intestine.

Contraction of Muscle.—To avoid learning what would have to be unlearned in the course of deeper study, it should be noted here that the oxidations that go on in the body are not *exactly* comparable with those that go on in a burning fire. Thus, it is evident that the oxidations in the body go on at a much lower temperature than the true combustions of a fire or furnace. Again, while it is very useful to compare the food of the body to the fuel of the engine, since both form, along with the air, the original source of all the energy, the energy expended by a contracting muscle when it does work is not *directly* derived from the oxidation of food or fuel. The muscle is not an internal combustion-engine, as was formerly supposed. As Sir William Bayliss put it: "The muscular system is analogous to a gas-engine used to compress air into a reservoir, from which it is taken to drive, by its pressure, various machines and tools." In the first chapter of muscle-contraction, when the living threads of flesh-substance become shorter and broader, and thus do work, there is no using up of oxygen and no formation of carbon dioxide. So this is not combustion. But there is a liberation of lactic acid from the muscle fibre, and this brings about physical changes, *e.g.*, in the surface-tension, that result in contracting. It is as if the lactic acid pulled the trigger of a *shortening* spring in the muscle-fibre; but if the muscle is to return to the normal relaxation, the lactic acid must be removed. About a fifth of

it seems to be oxidised, being converted into carbon dioxide and water; and the energy furnished by the changes is sufficient to reconvert the rest of the lactic acid into its chemical precursor—a phosphate of sugar which is abundantly present in the muscle. Part of the energy takes the form of heat; the rest is changed into the potential chemical energy of the sugar. As the sugar or the animal starch (glycogen), which precedes it in the muscle, is derived from the digested food, one may say that the energy expended when the horse draws the plough comes from the corn and hay. As the carbon-compounds of the corn and hay were built up in the plant's photosynthesis by utilizing the radiant energy of the orange-red-yellow rays of the sunlight, we may say that the animal heat of the horse is transformed sunshine. If we go one step further, the sunshine is ultimately due to the disintegration of atoms, or to the destructive collisions of electrons and protons, in the sun's colossal furnace. So that is the fountain and origin of all the animal heat!

Calories.—So far then it is clear that the heat of the body is directly or indirectly due to the oxidation of the food, and the amount of heat the food can produce when oxidized in the body is theoretically the same as it produces if burnt in the air. The amount of heat is measured in terms of Calories, a "great Calorie," as it is called, being the amount of heat required to raise the temperature of a litre (rather less than a quart) of water by one degree Centigrade. As Professor V. H. Mottram puts it: it requires 100 great Calories to heat a litre of ice-cold water to the boiling point, and we can get considerably more heat by eating five ounces of lean meat.

Very important for those who feed stock, as well as for those who would dine wisely, is the question of the heat-yielding values of the different kinds of food, but we cannot do more than illustrate the point. There are three main kinds of food:—

- (a) the *proteins*, such as the gluten of wheat, the casein of milk, the vitellin of yolk of egg, and other albuminoid substances such as those composing about one ounce in five ounces of lean meat;
- (b) the *carbohydrates*, such as starch and sugar; and
- (c) the *fats*.

Now a gramme (28·4 to an ounce) of typical protein yields 4·1 great Calories in the body, but all proteins have not the same heat-producing value; a gramme of carbohydrate yields about the same; a gramme of fat more than twice as

much—9.3 great Calories. It should be noted that the living body does not manage to oxidize its protein food as thoroughly as it oxidizes the carbohydrates and fats, so that, as far as heat-production is concerned, proteinaceous food is less profitable than the others. Nevertheless it is from the proteins only that the wear and tear of the living tissues is made good.

Loss of Heat.—As we have said, heat is produced by the breaking-down (or katabolic) chemical changes that go on incessantly in the body, but the great producers of heat are the muscles and the glands, especially the big liver. The muscles of the heart, which never stop contracting, except for momentary rests between beats, must produce a lot of heat in a day. Where does all the heat go to, if only about a quarter of it is used in doing work? The answer is that most of it is lost from the skin by radiation or by evaporation, or by other forms of heat-loss; but a considerable amount is lost in respiration from the internal surface of the lungs, and everyone is familiar with the "hot breath" of a big animal. Everyone must also have noticed on a country road on a cold day that heat is lost from the horse's dung and urine, but this loss is small compared with that from the skin and the lungs.

The living body is often compared to an engine, and though the comparison soon breaks down—since the animal is a self-stoking, self-regulating, self-repairing, self-multiplying, self-guiding, and often self-conscious engine—there is this usefulness in it, that both engine and animal are arrangements for transforming matter and energy from one form to another and getting work done. But all higher animals are far ahead of, say, railway locomotives in their efficiency, that is to say, in the amount of work that they can do for a given supply of chemical energy in the form of fuel or of food as the case may be.

Of the heat produced by burning its fuel an ordinary railway engine only turns about 10 per cent. into work, the rest being wasted; but a higher animal utilizes 20-25 per cent. of the heat theoretically available from its food. It excels the engine, though it is none the less very wasteful. *How does it lose so much heat?*

Temperature of Various Animals.—The temperature of a healthy man is normally between 36.5° and 37.5° Centigrade; in fever there is a notable rise, which may be fatal. We may say that we feel cold or feel warm, but a thermometer in our mouth shows little change; and it is plainly necessary to distinguish

our *sensations* of being cold or being warm from the *actual* temperature which remains practically constant. It is interesting, however, to notice that the body-temperature falls in starvation, and sinks to below 30° at the approach of certain kinds of death. In our ordinary routine the minimum is at about 3 a.m. when the functions of the body are most quieted down. The maximum, on the other hand, is between four and five in the afternoon. This body- or blood-temperature that we are speaking about is the balance that an organism arrives at between the amount of heat produced and the amount lost. In birds and mammals it is so nearly constant for each particular species that a deviation from it points to something wrong. Hence the doctor or the veterinarian never omits to take the temperature of his patient.

Many birds have a temperature of 42° Centigrade, which would soon kill a man, and this hot-bloodedness is to be connected with several facts. (1) As everyone knows, birds are very active creatures with a highly-developed muscular system, the pigeon's muscles of flight sometimes weighing half of the whole body. (2) Birds have a very intense metabolism or chemical routine in the body; that is to say, there are very numerous chemical reactions going on per minute, far more than in a snake or a frog. (3) Birds have a very perfect non-conducting robe over their body, which checks the loss of heat, the plumage of birds excelling the pelage of mammals, fine as that often is. (4) As we shall notice later on, birds are not only hot-blooded, they are very perfectly warm-blooded—adjusting production of heat to loss with great constancy.

Among mammals, bats have the highest temperature, as we might expect in creatures with the power of flight. The lowest temperatures are found in the two egg-laying mammals, in several ways reptilian, namely, the Duckmole and the Spiny Anteater, which vary from 25° – 28° C., and change very readily. Most mammals, however, have temperatures not very different from our own, thus the following figures are given by Halliburton: horse and ox, 37.5° – 38° ; dog and cat, 38.5° – 39° ; sheep and rabbit, 38° – 39.5° C.

Warm-Blooded and Cold-Blooded.—People often object to technical names, and with some reason; yet we have only to look around to see that popular names are sometimes misleading, and there is a good example in these two terms—"warm-blooded" and "cold-blooded." They do not quite express what they really mean. The only "warm-blooded" living beings are birds and mammals; but no one can suppose

that a snake or lizard basking on the desert under a tropical sun has a low temperature. Fishes are mostly very cold, and all are cold-blooded, yet the big tunny common in the Mediterranean has a very distinct temperature. No backboneless animals show any sign of being warm-blooded, yet the interior of a White Ants' nest may have a temperature 25° Fahr. higher than that of the outside world. These very muscular insects produce much heat; the substantial non-conducting clay walls conserve this, and the loss is sometimes lessened by the presence of hundreds of thin-walled empty cells in the interior of the termitary. This helps us to understand why the six-foot-long Monitor lizard should have discovered that the earthen nest of one of the commonest South African White Ants or Termites is a very suitable cradle for its big eggs, which it deposits in the very heart of the remarkable edifice. The air is moist and there is central heating—both very advantageous for the development of the embryo lizards inside the eggs. Even in the bee-hive and the wasps' nest there is a demonstrable warmth, due to the insects themselves, apart from the heat of the sun. Our point is simply that a cold-blooded animal may be warm, while a warm-blooded mammal sometimes has a temperature considerably below ours or below the cow's.

The fact is that cold-blooded animals are those whose body-temperature (measured by a thermometer placed in the mouth, or the armpit, or some such place) is changeable, tending to approximate to that of the surrounding world; whereas warm-blooded animals have an almost constant temperature, day and night, year in and year out. Hence the use of the technical terms—*poikilothermal* for cold-blooded (*poikilo*, changeable; *thermal*, warmth); and *stenothermal* for warm-blooded (*steno*, constant; *thermal*, warmth). For warm-blooded, some say *homoiothermal* (*homoio*, uniform; *thermal*, warmth).

When a mammal is losing much heat on a frosty day, the blood becomes a little colder and as it flows through a part of the brain (the heat-regulating centre) the lowered temperature affects the nerve-cells. Whereupon, in accordance with their pre-disposed susceptibilities and linkages, they send messages to the muscles commanding them to produce more heat, as they forthwith proceed to do. Other messages pass to the blood-vessels of the skin commanding them to contract—as when we become pale with cold—and this reduces the loss of heat.

Conversely, on a very hot day, the automatic regulation works equally well; messages pass to the mammals' sweat-glands, commanding profuse perspiration, and the evaporation of the sweat from the surface lowers the temperature. Further, the breathing movements are quickened, as we see in the panting dog, and that means cooling. Again, in the heat of day many of the birds and beasts keep very quiet, which lessens the production of heat by the muscles. As birds do not sweat, the automatic cooling is more difficult in their case; and many of them seek cover and shade when it is very warm.

There are not many fitnesses or adaptations that work with more efficiency than this automatic heat-regulating (or thermotaxic) arrangement; and its perfection is accentuated when we notice that it is often far from ready at birth. Thus the nestling bird is still very imperfectly warm-blooded, and soon becomes fatally cooled if the mother-bird does not return. The young bird is climbing up its own genealogical tree, for birds evolved from reptiles, and reptiles are cold-blooded. Similarly in some very young mammals, especially those born naked, the heat-regulating arrangement is not fully developed; so it is essential that they should be protected by the mother or in a nest. This is true of human babies born very prematurely; they need an incubator.

A few mammals remain throughout life imperfectly warm-blooded, and it is interesting to notice that they have become the hibernators, like hedgehog and dormouse, to which we referred in our "Biological Walk" in the November, 1930, issue of this JOURNAL (p. 759).

Use of Animal Heat.—We have kept this question to the end because it seems clearer to begin by laying emphasis on the fact that the production of heat is a necessary consequence of the disruptive or chemical changes that go on in the body—just as necessary as the production of heat in a test-tube when certain reactions take place. Even plants may produce heat, as has been shown in the crowded flowers of the Calla Lily or of the Cuckoo Pint within their spathe. When fermentations are going on, as in germinating seeds or heating hay-ricks, there is a production of heat. This is often associated with the activity of microbes, and everyone is familiar with the steam rising from an opened dung-heap. The production of heat is a general concomitant of the process of living, but it has not been much studied except in mammals.

In some insects, which vie with birds in their activity, the temperature of the body may be several degrees above that

of the surrounding world, but in most of the lower animals the heat seems to be lost almost as soon as it is produced. In a few cases only, like the tunny already mentioned, does the heat accumulate sufficiently to be appreciable. Only in birds and mammals, as we have explained, is there a device for keeping up a constant temperature. Why should this conduce to a more effective life? The answer is that certain chemical processes proceed more quickly and easily when considerable heat is available, and that arrangements securing a constant high temperature make the chemical processes go on not only more briskly, but more smoothly. Animal Heat helps the animal to make the most of its energy.

* * * * *

CULTIVATION OF THE SUGAR BEET CROP THREE YEARS' INVESTIGATIONS OF THE EFFECTS OF SPACING

W. MORLEY DAVIES, M.A., B.Sc., A.I.C.,
Advisory Chemist, West Midland Province.

Introduction.—The introduction of a new crop into farm practice raises a primary need for reliable information on numerous points, such as varietal characteristics, cultural treatment and manurial treatment. With a crop like sugar beet, it is necessary, moreover, that this information shall cover not only the yield, but also the composition of the crop and, in particular, its sugar content.

Practical guidance on these points must be sought by means of field tests conducted throughout the areas in which the beet is to be grown, as experience gained elsewhere is liable to be an uncertain guide. Whether these tests deal with varieties, cultural methods, or manuring, the results obtained at any one centre can have but more or less limited application until confirmed by repetition elsewhere. This statement may possibly be truer of the results of manurial than of cultural experiments. To obtain really reliable information on the question of manuring the sugar beet crop, the writer believes that only a scheme of well-planned experiments, on a national or equally wide basis, of which the results could be subjected to statistical criticism, would be of much value and likely to lead to definite conclusions. Such an opinion seems to be justified by the diverse results obtained during two years' of manurial experiments carried out in various counties.

Of the several factors above mentioned, the trials under notice were concerned during the past few years with the

study of the effect of one cultural factor, the spacing of the plants, upon the yield and sugar content of sugar beet grown on, and in the neighbourhood of, the Harper Adams College Farm, which is situated in the north-eastern portion of the county of Shropshire. Other factors were also brought under observation, but were studied less closely. It is with spacing, therefore, that we are primarily concerned in this article, which summarizes the work done during the three seasons, 1927-29.

First Year (1927).—The experiments of this year were planned to cover spacing within and between the rows, sub-soiling, and planting on the ridge and flat. The experimental area was laid down as shown in Fig. 1, giving quarter sections as follows :—

- Sub-soiled, ridge sown.
- " flat sown.
- Not sub-soiled, ridge sown.
- " " flat sown.

Each of these quarter sections was further divided into 20 plots to provide all possible combinations of the following distances between the rows and of hoeing :—

Width between the rows : 16, 18, 20, 22 and 24 inches.

Width of hoes used : 4, 6, 8 and 10 inches.

It will be seen that the whole scheme comprised 80 plots, divided into four groups of 20 each, so far as the spacing test was concerned. The area of each small plot was approximately one-twentieth of an acre.

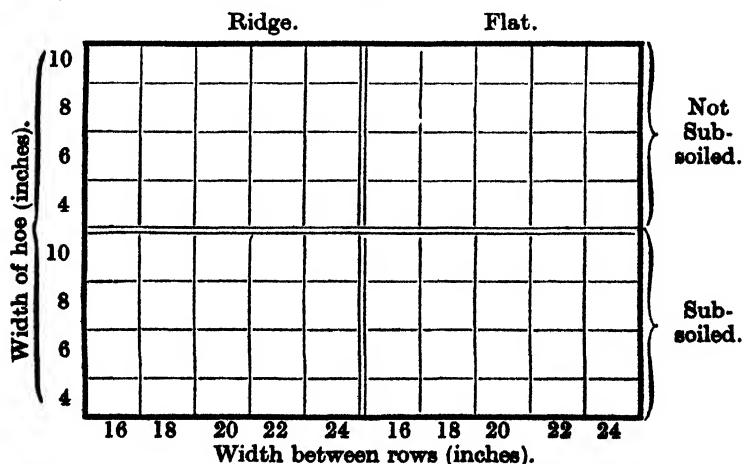


FIGURE 1.

Lifting was carried out early in November by removing 10 half-chain lengths from each plot for gross weight. From

these, 50 beet were taken at random for estimating the dirt tare and sugar content.

The experiment was laid down on a loamy sand, and, except for those under examination, all the factors were kept as constant as possible. The results are later discussed in detail.

Second Year (1928).—In this year attention was concentrated entirely on the question of spacing and the arrangement was modified accordingly, the arrangement being shown in Fig. 2.

Spacing between plants in inches.				Width of Rows. inches.
6	4	10	8	18
8	6	4	10	21
10	8	6	4	24
4	10	8	6	15
8	6	4	10	21
10	8	6	4	24
4	10	8	6	15
6	4	10	8	18
10	8	6	4	24
4	10	8	6	15
6	4	10	8	18
8	6	4	10	21
4	10	8	6	15
6	4	10	8	18
8	6	4	10	21
10	8	6	4	24

FIGURE 2.

It will be noted that four different spacings between the plants (4, 6, 8 and 10 inches) were used and similarly four different spacings between the rows (15, 18, 21 and 24 inches), the latter being repeated four times, the whole thus forming a

16-plot test in quadruplicate or 64 plots in all. The soil was a loamy sand.

In order to secure greater accuracy, a much smaller size of plot was used than in the previous year so that the whole of the necessary cultivating, sowing, etc., could be carried out by hand labour. The total area of the 64 plots was about $\frac{1}{2}$ acre, giving an area of $1/256$ acre per plot.

The desired spacings between the plants in the row were obtained by the use of marked rods laid alongside the rows, the use of standard hoes, as in the previous year, being insufficiently precise for small-scale work. The whole area was sown on the flat and received uniform manurial treatment.

Each plot consisted of seven rows, the outer ones of which were discarded at harvest time. The number of plants per plot varied from 90 on the widest spacings to 250 on the narrowest.

Harvesting was carried out by lifting 50 beet at random from each plot for estimation of dirt tare and sugar content. Of these the tops and crowns were separately estimated. The remainder of each plot was pulled, washed and weighed. It was possible in this way to obtain information on the accuracy of the usual procedure (by taking 50 beet at random) for the estimation of dirt tare. The results of the 1928 experiment are reviewed later.

Third Year (1929).—In design and execution, the experiments of this year were somewhat similar to those of the previous year, except for difference in the soil and the number of spacings, as shown in Fig. 3.

It will be noted that in this year five different spacings (12, 15, 18, 21 and 24 inches) between the rows were included, whilst the four spacings within the rows were taken at 4, 7, 10 and 13 inches. These spacings not only were intended to cover the range likely to be used in practice, but also to give information on the effect of going above and below these limits. The test was again in quadruplicate, giving 80 plots. The total area of the plots was about $\frac{1}{2}$ acre, each individual plot being, therefore, about $1/100$ acre. Each plot contained 10 rows, of which the centre six were harvested and the remainder discarded.

The experiment was conducted on a deep sandy soil, somewhat coarser and lighter than the soils of the two previous seasons. Harvesting was carried out by pulling, topping, washing and weighing all the beet from each plot. Sampling for dirt tare was carried out as in the previous year.

Spacing between plants in inches.				Width of rows. inches.
4	7	10	13	15
13	4	7	10	12
10	13	4	7	21
7	10	13	4	18
13	4	7	10	24
4	7	10	13	12
10	13	4	7	18
4	7	10	13	24
13	4	7	10	21
7	10	13	4	15
4	7	10	13	21
7	10	13	4	24
13	4	7	10	18
10	13	4	7	15
7	10	13	4	12
13	4	7	10	15
7	10	13	4	21
10	13	4	7	12
4	7	10	13	18
10	13	4	7	24

FIGURE 3.

Meteorological Conditions.—A statement of results would be incomplete without reference to the meteorological conditions prevailing during the three seasons. Tables have been compiled consisting of data abstracted from the daily readings. These, for reasons of space, cannot be printed here in full, but are summarized below.

The weather during the growing periods of the three seasons 1927, 1928, 1929 offered great contrasts. In 1927, the rainfall was moderate in spring and higher in the summer. The

average daily hours of sunshine were never high, while the accumulated day degrees were approximately equal to those of the corresponding months in 1928 and 1929.

The growing season of 1928 was on the whole less rainy. Except for the months of April, May and June, the accumulated day degrees per month were only slightly lower than in 1927. The daily sunshine average was, however, higher, except in the months of April and May.

In 1929, the rainfall was low, and the number of days on which heavy rain fell were few. The combination of these two factors, coupled with the many hours of sunshine, led to the wilting point being frequently reached on the narrower spacings. Such rain as fell was usually so slight that it dried away in a short time. In interpreting rainfall figures, not only the total rainfall figures but the quantity which fell at any one time should be taken into account.

As experience accumulates, it seems to become more and more evident that meteorological conditions have a profound effect on the yield and sugar content of the crop. In support of this statement, the average sugar content figures for the three years are interesting :—

1927	..	..	..	16.3	per cent. sugar.
1928	..	..	..	17.4	" "
1929	..	..	..	18.2	" "

In each case it seems evident that the sunshine records are closely correlated with the sugar content.

Agricultural Conditions.—Ploughing.—In all three seasons, the fields were deeply ploughed, and in 1927 the part indicated in Figure 1 was also sub-soiled.

Manuring.—In all cases farmyard manure had been applied to previous crops. The usual practice of applying a balanced mixture of artificial fertilizers was followed.

Seeding.—This was at the rate of about 20 lb. per acre, applied in the first year with hand and corn drills, and in the second and third years with hand drills. It may be of interest to anyone contemplating sugar beet experimental work to note that it is imperative to seed heavily and to drill each row at least twice to get an even distribution of seed.

Further Cultural Operations.—Only in the first year were any succeeding cultivations carried out by horses, and even then, in the 16-in. drills, hand labour had to be used. Otherwise, all the subsequent operations were carried out by hand.

Results of Experiments : Variation in the Distance between the Rows.—The summarized results of the three seasons can be examined in Table I :—

TABLE I

1927			1928			1929		
Distance between rows in.	Yield (Tons per acre)	Sugar Content p.c.	Distance between rows in.	Yield (Tons per acre)	Sugar Content p.c.	Distance between rows in.	Yield (Tons per acre)	Sugar Content p.c.
16	14·96	16·2	15	13·67	17·33	12	11·34	18·24
18	13·46	16·4	18	13·28	17·35	15	11·23	18·21
20	12·01	16·0	—	—	—	18	11·19	18·19
22	11·96	16·6	21	13·03	17·43	21	10·73	18·22
24	11·49	16·6	24	12·63	17·34	24	10·64	18·15

It will be observed that, in all three cases, a marked and significant increase in tonnage takes place with decreasing distance between the rows. This is most marked in the season 1927, and amounts to a difference of $3\frac{1}{2}$ tons per acre between the widest and narrowest spacings.

For the Season 1927, a statistical analysis of the results indicates that the differences between the resulting yields on the 16-in. and 18-in. rows and those on the wider distances may be taken as definitely due to the difference in spacing. The differences between the 20-in., 22-in. and 24-in. spacings may be due to chance, and cannot therefore be regarded as significant. The conclusion that the highest yields are to be expected on the narrower rather than the wider spacings was corroborated by numerous experiments in adjacent counties.

In the Season 1928, the differences between the 15-in. and the 21-in., the 15-in. and 24-in., and the 18-in. and 24-in. spacings were significant. It is interesting to note that, in this season, the weights of crowns and tops were 1·5 tons and 20·2 tons per acre respectively. No significant differences between the weights of tops and crowns from different spacings between the rows were evident.

In the Season 1929, the results verify those of the two previous seasons and show a similarly increasing yield of roots with decreasing distance between the rows. There is little doubt that the results for this season would have been more strongly marked had the rainfall been higher, the effects of the drought falling most heavily on the narrower spacings. Frequently the wilting point was reached on the narrower

spacings, and this must have contributed to a substantial reduction in the yields.

Summarizing the three years' work, it seems clear that farmers aiming at high yields should grow their beet closely spaced in the rows. The question of degree must be left to the grower and will be influenced somewhat by the kind of soil and its freedom from weeds, especially those with strong rooting systems. On light soils, the topography or nature of which conduces to drought, spacings wider than 18 in. are probably advisable.

As a result of the three years' investigations a distance of 18 in. seems to be indicated as the optimum spacing, and it is interesting to note that many farmers in the West Midlands now adopt this distance.

Effect on Variation in Distance between Plants in the Row.—

Table II shows the collected results on this point for the three years.

1927		1928			1929		
Hoes. in.	Washed Beet (Tons per acre)	Distance between plants. in.	Washed Beet (Tons per acre)	Sugar per- cent.	Distance between plants. in.	Washed Beet (Tons per acre)	Sugar per- cent.
4	12.63	4	13.43	17.41	4	10.63	18.08
6	12.97	6	13.08	17.35	7	10.89	18.22
8	12.99	8	13.05	17.33	10	11.54	18.28
10	12.49	10	13.05	17.45	13	11.05	18.23

It is an exceedingly interesting fact that, unlike the effects of differing row widths, varying distances between the plants have no significant effect on the yield, at any rate up to a distance of 10 inches. This fact is borne out by the results of all three years except in one instance, namely, the difference of the yields between the 4-in. and 10-in. distances in 1929, when a significant difference is shown. It is felt here that this difference would not have occurred but for the abnormality of the season when the plants on the narrow 4-in. spacing suffered severely from the drought.

Reference to the 1929 figures, and also to those in Table III, suggests that, for distances above 10 in. apart, a diminution in yield takes place.

For purposes of comparison a summary is given in Table III of results obtained in experiments at two centres in Staffordshire, carried out by the County Advisory Staff.

TABLE III—STAFFORDSHIRE COUNTY COUNCIL EXPERIMENTS, 1927

		<i>Himley</i>	<i>Enville</i>	
Narrow singling	7-8 in. . .	12-32	13-25	} Washed beet, tons per acre
Medium „	9-10 in. . .	12-68	13-55	
Wide „	11-12 in. . .	11-71	12-53	

The conclusive results of the three years point to the fact that narrow spacings between the plants give no advantage, at any rate up to a width of about 10 in.

These conclusions have considerable practical importance, since singling, being a hand operation, is one of the most tedious phases of beet cultivation and, at the same time, one of the most difficult to regulate. Rowing up, on the other hand, is mechanical, and it is merely a matter of contrivance to obtain narrow rows.

Effect of the Area per Plant on the Yield.—By combining the results for distance between the rows with those for width apart in the row, we get the effects of the area per plant as shown in Tables IV and V for the years 1928 and 1929.

TABLE IV. -1928

Spacing (in.)	Area (sq. in.)	Washed Beet (Tons per acre)	Sugar percentage	Sugar (Tons per acre)
15 × 4	60	14-14	17-19	2-43
18 × 4	72	13-55	17-34	2-35
21 × 4	84	12-94	17-54	2-27
15 × 6	90	13-97	17-38	2-43
24 × 4	96	13-11	17-29	2-27
18 × 6	108	12-55	17-32	2-17
15 × 8	120	13-46	17-40	2-34
21 × 6	126	12-81	17-34	2-22
24 × 6	144	12-99	17-36	2-26
18 × 8	144	13-40	17-38	2-33
15 × 10	150	13-12	17-33	2-27
21 × 8	168	12-96	17-26	2-24
18 × 10	180	13-61	17-37	2-36
24 × 8	192	12-37	17-28	2-14
21 × 10	210	13-41	17-59	2-36
24 × 10	240	12-05	17-41	2-10

The rather surprising conclusion is evident that, despite the great difference in area per plant, there were no significant differences in yield per acre in either year, except that (in 1928) the lowest returns were obtained on the maximum area per plant, and the highest on the minimum area. There is no relation either between the area (and probably the weight) per plant and the sugar content.

TABLE V—1929

Space per plant (Sq. in.)	Dimensions (in.)	Average of 4 plots (Tons p. acre)	Sugar percentage	Sugar (Tons per acre)
48	12 × 4	10.95	18.14	1.99
60	15 × 4	11.14	18.23	2.03
72	18 × 4	11.33	18.49	2.10
84	21 × 4	9.95	17.92	1.78
84	12 × 7	11.45	18.14	2.08
96	24 × 4	9.80	17.88	1.75
105	15 × 7	10.63	18.18	1.93
120	12 × 10	12.27	18.23	2.24
126	18 × 7	10.72	18.11	2.37
147	21 × 7	11.06	18.28	2.02
150	15 × 10	11.28	18.35	2.07
156	12 × 13	10.69	18.30	1.96
168	24 × 7	10.59	18.31	1.94
180	18 × 10	11.65	18.10	2.11
195	15 × 13	11.87	18.10	2.15
210	21 × 10	11.15	18.29	2.04
234	18 × 13	11.08	18.41	2.04
240	24 × 10	11.34	18.37	2.08
273	21 × 13	10.75	18.23	1.96
312	24 × 13	10.85	18.43	2.00

The returns for 1929 suggest similar conclusions. Increased area per plant seems to be balanced by an equivalent increased size of the plant.

Effect of Spacing on Sugar Content.—No general relationship between sugar content and spacing has been evident. There seemed to be some suggestion that the sugar content decreased with increasing distance between the rows in 1927, but this was not verified in 1928 and 1929.

The reasonable deductions seem to be that the rows should be spaced at 18 in. and the plants in the row at 9 in.

Relative Importance of Weight per Acre and Sugar Content.—On the present basis of agreement between the factories and the farmers, payment is made both on the net weight of beet supplied and on the sugar content of the beet. Improvement in either increases the returns. The question at once arises, therefore, as to how far the farmer has the control of these factors.

The cultural experiments dealt with above suggest one way, at least, in which the farmer may confidently look for increasing the yield of beet. Other factors, also, such as proper manuring, freedom from gaps, cleanliness of land, &c., all contribute to higher yields per acre.

The control of sugar content presents more difficult problems. The farmer, except in the choice of variety, has practically no control of the sugar content. The whole matter is but imperfectly understood, but it is probable that sunshine, temperature, and variety are the most important factors. Some investigations have furnished evidence that manuring also may have some slight influence, excess nitrogen and lack of potash both tending to decrease the sugar content. On the whole, therefore, growers would seem to be well advised to concentrate on growing the highest tonnage per acre possible, leaving the sugar content to the chance of the season. This generalization may require some modification, however, in the case of growers living far from the factory; the consequent heavier freightage charges may make it desirable to choose a variety giving a higher sugar content with a lower yield.

Other Information Derived from the Experiments.—

Influence of Sowing on the Ridge versus Flat.—The point was investigated in the year 1927 only. The results distinctly favoured the ridge, where the weight was 13·41 tons per acre of washed beet compared with 12·14 on the flat. This was supported by results in the same year from Staffordshire and Shropshire. For various reasons, but chiefly to the introduction of time-saving machines, most of the beet in the West Midlands is now grown on shallow ridges or else on the flat. On the whole, the high ridge does not seem suitable for beet, because of the difficulty of controlling attacks from Spring-tails, and of keeping the beet adequately covered to prevent green crowns.

Influence of Subsoiling.—The scope for improvement by subsoiling must naturally vary on different soils. Up to the present, there are no exact criteria for predetermining whether a particular soil may need subsoiling or not. In the case of the 1927 experiments the results were inconclusive, giving an average of 12·98 tons per acre on the non-subsoiled and 12·57 tons on the subsoiled part.

Yield of Tops and Crowns.—Determinations of these quantities were made in 1928 only. The yield of crowns was about 1·5 tons per acre, with a sugar content of only 10 per cent. In the same experiment, the yield of green, unwilted tops was about 20 tons per acre. It is interesting to note that the weights of tops on various spacings between the plants showed significant differences, while the weights on the different row spacings did not.

From an analysis of the tops and crowns it was concluded that ploughing these in would be equivalent to a dressing of about 11 tons of farmyard manure per acre.

Dirt Tare.—Very considerable variation was found in the dirt tare of samples of 50 beet. In the experiment of 1928, when all the pulling was carried out uniformly during dry weather, the dirt tare varied in different samples from 9 to 41 lb. per cwt. It is probable that variation in the degree of fanging of the roots accounted for the very considerable variations in dirt tare on different plots.

Summary.—(1) The evidence of the three years' (1927-28-29) experiments in sugar beet growing shows a very decided advantage in favour of narrow spacing of the rows. This is corroborated by external evidence from county experiments. While practical considerations possibly rule out 16 inches at present, it seems that expectation of consistently high yields can only be realized by narrow spacing.

(2) The results of the three years' experiments do not show any significant differences in the yields of roots grown on different spacings in the row. The evidence shows that just as high a yield is obtained with 10-in. as with any smaller spacing. Above 10-in. the yield shows a decrease.

(3) The effect of variation in the number of plants per acre (otherwise expressed as area per plant) has no corresponding response in yield or sugar content. Almost equal yields were obtained when the number of plants was small as when it was large. A spacing of 18 in. \times 9 in. seems suitable for Midland conditions.

(4) On fields where the soil has no tendency to form hard lower layers, the necessity for subsoiling was not apparent. The crop, however, is one for which deep cultivation is essential.

(5) Yields of sugar beet grown on the ridge and flat in 1927 showed an advantage in favour of growing on the ridge. Possibly the greater risk of insect attack may over-ride such advantages and make growing on the flat preferable.

(6) The yield of crowns bears no relation to spacing.

(7) The yield of tops shows a definite relationship with spacing. Significant differences in yield were apparent in 1928 with varying spacing in the row but not between the rows. This is in the opposite direction to the results stated above for the variation in yield of roots.

(8) Meteorological conditions undoubtedly play an important part in control of yield and sugar content.

(9) No general relationship between sugar content and spacing is evident.

(10) Under the existing agreements with the factories, most growers are advised to try to obtain a higher tonnage rather than a higher sugar content. This advice may need some modification for growers living a great distance from the factory.

The writer wishes to record his warm appreciation of the services of numerous colleagues (both in the College and in the neighbouring counties) who contributed in no small degree to the satisfactory conduct of the various experiments.

WEEDS OF GRASS LAND—II*

H. C. LONG, B.Sc. (Edin.),

Ministry of Agriculture and Fisheries.

Weeds Related to Soils.—During the last twenty years progress in our knowledge of grass land and its associations and improvement has increased at a great rate, and a few points of interest and value may suitably be mentioned here. It is, for example, useful to bear in mind that many grassy heaths have probably been developed from *Calluna* heaths, the *Calluna* (ling or heather) having been suppressed by rabbits and grazing sheep. Indeed, it is remarkable that in the eastern counties the term "heath" is still applied to areas, even on the Chalk, that are now pastures on which true heath plants are no longer found. The result of grazing by rabbits and sheep is well established.¹ It would seem also that mowing before the seed is ripe has been effective in reducing heather on Newmarket Heath. Further, Farrow suggests that the influence of rabbits was sufficient to bring about the replacement of the Scots pine by bracken, and thence leading to a grassland period on these heath lands.

The effect of rabbits and sheep has also been studied by Tansley and Adamson² on English chalk grass lands, and there seems no doubt that changes occur according to the extent of the grazing; these authorities observe that "the great bulk of the English chalk grass land is a community fixed and to

* The first article appeared in the issue of this JOURNAL for December, 1930, p. 871.

¹ The Ecology of the Vegetation of Breckland, E. Pickworth Farrow : *Jour. Ecol.*, XIII, 1925.

² Studies of the Vegetation of the English Chalk, A. G. Tansley and R. S. Adamson : *Jour. Ecol.*, XIII, 1925 ; XIV, 1926.

some extent modified by continuous grazing," which, indeed, seems to be the one factor that inhibits the eventual passing of such areas into chalk heath characterised by *Calluna* (heather or ling), *Erica* (heath), etc., and thence into woodland.

An investigation by Salisbury³ led him to the conclusion that "the main factor which is responsible for the incidence of species is the reaction of the soil, which is one of the several important factors that govern the distribution of plants in the wild state."

Hopkinson⁴ has shown that, on the Bunter Sandstone of Notts, land that is going out of cultivation, e.g., arable land in second-year grass (third year of rotation), has been observed to contain 33 per cent. of the species found on grass heaths. *Rumex acetosella* (sheep's sorrel) is generally dominant in the first few years, and is followed by *Luzula campestris* (field woodrush), *Agrostis vulgaris* (bent), *Holcus mollis* (creeping soft grass), etc., while arable weeds disappear. *Deschampsia flexuosa* (wavy hair grass) later becomes dominant and forms the characteristic tussocky turf, *Senecio jacobaea* (ragwort) often appearing also.

On the chalk downs Anderson found⁵ that the most deeply-rooted species among the flora included *Ononis spinosa* (rest-harrow) and *Poterium sanguisorba* (burnet)—both of which may run to a depth of 3 ft. The average depth of 50 characteristic species was 4–8 in. On these soils the largest average water supply was furnished by the surface 3 in. of soil.

In a later discussion of the flora of the chalk downs Anderson has shown⁶ that the bulk of the feeding roots are usually developed at a depth of 16–27 in., though as already observed the average working depth of the feeding roots of some 50 species was 4–8 in. only. Further, even on such soils, leaching of calcium carbonate may proceed so far that in one case it was reduced in the top 3 in. to less than 0.02 per cent. (whereas at 9 in. depth 82 per cent. of the dry weight consisted of carbonates). Such a fact may well explain the appearance of ling (*Calluna vulgaris*). On these chalk soils, *Brachypodium pinnatum* (tor grass) seems to be spreading extensively on the South Downs, and tends to suppress other herbage. Evapora-

³ The Incidence of Species in Relation to Soil Reaction, E. J. Salisbury : *Jour. Ecol.*, XIII, 1925.

⁴ The Ecology of the Bunter Sandstone, J. W. Hopkinson : *Ibid.* p. 130.

⁵ The Water Economy of the Chalk Flora, V. L. Anderson : *Jour. Ecol.*, XV, 1927, p. 72.

⁶ The Flora of the Chalk Downs, V. L. Anderson : *Sci. Progress*, Jan., 1928, p. 444.

tion of moisture also leads to dryness of the top soil, and this tends to the presence of plants that are deep-rooted and can withstand drought. Sheep and rabbits keep the herbage closely grazed, so that few tall-growing plants are seen. Among common weeds are *Carex flacca* (glaucous sedge), *Thymus serpyllum* (wild thyme), *Linum catharticum* (purging flax), *Poterium sanguisorba* (burnet), *Galium verum* (lady's bedstraw), and many others.

Stapledon and Hanley⁷ indicate that on acid soils and in smoky districts neglected grass is chiefly composed of bent, while on the light sandy soils *Holcus mollis* (creeping soft grass) takes possession of large patches, and on the poorer soils such weeds as yarrow, field woodrush, earth-nut, Yorkshire fog and sheep's sorrel are common; on peaty soils there is commonly a rank growth of coarse grasses and weeds, and *Agrostis alba* (fiorin) is difficult to keep in check; on the peaty sands ragwort is one of the characteristic weeds; on unimproved and undrained damp soils rushes and the common sedge (carnation grass) grow freely; while "old grass land impoverished by mowing year after year without manures is often characterized by the presence of yellow rattle, ox-eye daisy, sorrel dock (*Rumex acetosa*), Yorkshire fog and soft brome.

It has been found⁸ also that the weed flora of pasture plots was small and in marked contrast to hay plots.

It may be said that within broad limits the following species of grassland weeds are related to the types of soils mentioned:—

<i>Damp Soils</i>	<i>Neglected and Poor Soils</i>	<i>Heavy Land</i>
Rushes	Yorkshire Fog	Horsetails
Certain Sedges	Quaking Grass	Coltsfoot
Horsetails	Sterile Brome Grass	Knapweed
Cotton Grasses	Ox-eye Daisy	Ragwort
Silver-weed	Knapweed	Buttercups
Tussock Grass	Yellow Rattle	Dandelion
Certain Mosses	Dyer's Green-weed	Silver-weed
Cowslip	Rest Harrow	Wild Onion
Butter-bur	Sheep's Sorrel	Bent Grasses
Lady's Smock	Ragwort	Wild Carrot
Meadow Sweet		
Ragged Robin		
Coltsfoot		
Orchids		
Wild Onion		

⁷ Grass Land, Its Management and Improvement: R. G. Stapledon and J. A. Hanley, 1927.

⁸ e.g., A Botanical Study of Pasture Plots, E. Wyllie Fenton: *Ann. of Appl. Biol.*, XVII, 3, 1930, p. 522.

<i>Calcareous Soils</i>	<i>Soils in Need of Lime</i>	<i>Good or Loamy Soils</i>
Burnet	Sheep's Sorrel	Buttercups
Chicory	Ox-eye Daisy	Spear Thistle
Viper's Bugloss	Bracken	Coltsfoot
Stemless Thistle	Foxglove	Stinging Nettles
Wild Thyme	Gorse	Dandelion
Erect Brome Grass	Broom	Mouse-ear Chickweed
Tor Grass	Heather	
	Heaths	

It must not, however, be assumed that because certain of these weeds are found they specifically indicate the character of the land ; the above list is quite general and suggestive rather than arbitrary. Individual species may occur on a soil on which they are not usually plentiful, but may not be at their best, being more certainly characteristic of a different soil type. The stemless thistle, for example, may possibly be found on a soil rather deficient in lime, though it occurs at its best and in greatest profusion on calcareous soils.

General Methods making for Improvement.—When we come to consider the various factors that may be expected to make for the improvement of grass land, we may find that certain of them are already in action, but need others to be introduced if the best influence is to be ensured. Grazing may be efficient, as far as it is possible, but draining may be needed ; drainage may be satisfactory, but lime and fertilizers may be wanting ; or drainage, lime and fertilizers may be attended to but grazing be so badly managed that the possible benefits may be missed. A good sole, comparatively free from weeds, can be best assured by concurrent attention to a number of details. These may be briefly considered in turn.

Drainage.—It has been long recognized that farm land of all types must be effectively drained if it is to produce food crops, whether on grass or arable land. In recent years widespread attempts have been made, and are continuing, to improve the general "tone" of drainage throughout the country, both by arterial and field drainage, and the Land Drainage Act of 1930 represents a further attempt to bring about a much-needed improvement. Without satisfactory drainage the soil lies too damp, ineffectively aerated, unfit for the proper functioning of the roots of plants or the utilization of such lime and fertilizers as may be employed. Further, one of the needs in regard to grass land is earliness in the spring. Damp, under-drained grass land, however, is commonly unsuitable for grazing in the

early months of the year and in the autumn and winter, such land being late rather than early. Effective drainage, if it be only by means of the mole outfit, will soon add considerably to the extension of the grazing season, and prove more healthy for the grazing stock—an additional reason for attending to the drainage when attempts are being made to secure an early bite.

The subject need not be elaborated here ; it may suffice to say that many weed species are found in great plenty on wet or damp grassland areas, from which they are likely to disappear—at any rate in large part—once the improvement due to drainage sets in. The high quality of much good low-lying grass land depends very largely on the adequacy of the drainage. Moisture is highly necessary for the successful growth of grass, but waterlogging is very injurious. On the other hand, in some instances much improvement may be brought about by the use of lime and phosphates, followed by sound grazing, without the necessity of further draining—the lack of percolation of water being largely due to bad management. Lime, phosphates and close grazing may alone lead to immense improvement. There are, however, instances where lime and basic slag or mineral phosphates do not work well together, and the use of lime may be of little value if basic slag is given.

Liming.—Soils of the peaty and acid types cannot be expected to improve as they should, following effective drainage, unless the acidity is overcome by the use of lime. In general, it is likely that low-lying, damp or wet land will need lime following the drainage operation. Soils of all kinds, however, may usefully be tested for lime content before a decision as to liming is taken. It is widely recognized that a very large proportion of our grass land would be improved by liming—even some soils overlying the Chalk, where the surface lime has been carried rather low for the use of many surface-rooting plants.

Many experiments, including those at Rothamsted, have indicated the great value of liming. As much as a generation ago the Rothamsted experiments had shown the striking effect of lime on grass land, lime producing a considerable increase in crop on the average of the first crops for three years; there was also “ a great increase in the proportion of leguminous plants.” At Cockle Park the application of lime was found considerably to increase the yield of ribwort, but considerably to reduce the percentage of bent and Yorkshire fog. Drained grass land that has been limed is likely to contain a far greater

variety of species of herbage than similar land undrained and unlimed, while the species will be more nutritious and more productive. It may, perhaps, be said that almost all grass land would be the better for an occasional dose of lime, say 10 cwt. per acre every four years; some of the acid soils on which "mat" is obvious, however, need a fairly heavy dressing (up to 2 tons) at the outset; and there are some types of land that do not necessarily require liming.⁹

A recent report¹⁰ discusses plants of grass land in relation to soil acidity, and it was remarked that the least acid soils were grazed best.

It is now well recognized that liming is more or less a specific remedy, over a number of years, against bracken, sheep's sorrel, ox-eye daisy, and some other weeds, especially if carried out in conjunction with judicious manuring and grazing.

Fertilizers.—Judicious manurial treatment must be considered with drainage and liming. Just as the use of fertilizers may miss a big part of the benefit if the amount of lime present is inadequate, so may draining and liming be much less effective if not followed up by manuring. In the words of Stapledon and Hanley: "A good herbage will not grow on land in bad condition, however assiduously the bad plants are uprooted." Manuring has a very great effect on the composition and quality of the herbage; this has been conclusively proved by many experiments and much investigation, and many practical farmers have long since proved it for themselves.

Permanent grass mown year after year for hay without being manured may not show a great falling off in quantity of crop, but the herbage will become steadily inferior in quality, and prominent among it are likely to be knapweed, yellow-rattle, burnet, Yorkshire fog, ox-eye daisy, sorrel, hawkbit, ragwort, etc.

It is essential that manurial treatment should not be one-sided; while the present-day intensive treatment of grass land with nitrogen, for purposes of close grazing, is quite sound, it must be accompanied by care that phosphates and potash are present in sufficient quantity, this depending very much upon the soil type. If ample minerals are present, nitrogen may be used frequently in small quantities, and if the repeated flush

⁹ Further information on liming will be found in *Grass Land*, Stapledon and Hanley, 1927; The Ministry's Bulletin No. 3, *The Improvement of Grass Land* (8d. post free); Leaflet No. 170, *The Use of Lime*.

¹⁰ The Distribution of Pasture Plants in Relation to Soil Acidity and other Factors, W. R. G. Atkins and E. Wyllie Fenton: *Sci. Proc. Roy. Dub. Soc.*, Vol. 19 (N.S.), 46, October, 1930.

of herbage is regularly grazed off, or mown, an improvement in the grass land, with a reduction in the weed flora, may be anticipated. Nitrogen alone is very unsatisfactory ; nitrate of soda appears to tend to an increase of weeds and coarse grasses in the greater bulk of hay, but to a reduction in clovers ; sulphate of ammonia, on the other hand, encourages sheep's fescue, bent and sheep's sorrel ; phosphates and potash alone encourage clovers, but do not suppress sorrel and yarrow ; lack of potash has led to an increase in knapweed, yarrow, plantain and buttercup ; superphosphate applied alone continuously is possibly as exhausting as nitrogen alone ; basic slag on " slag land " notoriously effects a remarkable improvement of the herbage, encouraging clovers and incidentally reducing the percentage of weeds and grasses present.

Investigations in 1927 in connexion with trials¹¹ on the improvement of grass land by close sectional grazing, nitrogenous manuring, etc., indicated that the only weed species that showed signs of increase under the new system was yarrow. The inferior grass, Yorkshire fog, showed very considerable active growth during the whole season. There seems some tendency for clover to be reduced by repeated doses of nitrogen and close grazing, but if this is not carried too far, and the autumn-spring herbage is increased, then the general effect is valuable.

Harrowing.—Emphasis needs to be laid on the real value of heavy drag or disc harrowing of much of our grass land before it is limed and manured. Sour, mossy, matted or foggy grass land requires the surface to be opened up to air and moisture, and many progressive farmers do not hesitate to treat such land somewhat roughly as a beginning of the improvement. This enables lime and fertilizers to exercise their full effect and gives wild white clover a chance to secure a firm footing.

Clearing Scrub, etc.—In a good many cases neglected grass land rapidly becomes rough with scrubby thorns, bushes and brambles ; these need attention when improvement is undertaken. They may be grubbed or even cut off close to the ground and thereafter cut as often as any fresh growth appears ; subsequent treatment (manuring and close grazing) will result in their being kept in check.

Wild White Clover.—Given efficient drainage, harrowing, lime and fertilizers, it is probably true to say that the securing of a good stand of wild white clover—sowing if need be—will

¹¹ *The Intensive Treatment of Grass Land*, Rt. Hon. Lord Bledisloe, K.B.E., 1928.

have a better effect in keeping down weeds of grass land than any other single item, so long, at least, as grazing is well managed. The value of wild white clover in reducing weeds has been emphasized many times by those well qualified to speak with authority. It is clear that as the proportion of clover is increased "other herbage" must decrease, and this decrease applies to weeds as well as grasses. The quality of the grazing may thus be greatly improved.

Mowing Roughage.—In the interests of grassland improvement it is desirable that rough foggage and tufts of withered grass and weeds should be mown over late in summer; this will enable young herbage to make satisfactory growth in early autumn for use during the remaining months of the year. It is sometimes considered that roughage is readily eaten down by grazing stock when keep is scarce in the autumn, but it is scarcely as good as young grass, in the interest of which its removal is to be recommended.

Early Mowing for Hay.—Many fields of neglected and unimproved grass laid up for hay are badly infested with yellow rattle, ox-eye daisy, Yorkshire fog, knapweed and other species that greatly reduce the value of the hay. It deserves to be borne in mind that numbers of these weeds are annuals, and that seeding may be prevented—and thus the extension of the weeds arrested—if the grass is cut for hay rather earlier than usual. Observation will indicate when the weeds are near the flowering stage, and this is the time to cut. Not only will weeds be reduced if this course is pursued for two or three years, but the hay will be of better quality, and so make up for some loss in weight.

Cutting Surplus Grass for Hay or Silage.—Where intensive manuring and rotational grazing are practised it may happen that the supply of grass gets ahead of the capacity of the stock to keep it down. In such an event it is very desirable that the grass shall not get coarse and afford an opportunity for weeds to mature; the grass should, therefore, be cut while still young, and be converted into hay or silage, which will be valuable fodder.

Consolidation.—On some light soils it may be necessary to consolidate the surface by heavy rolling; this will encourage wild white clover and add to the capacity of the soil to bring up water from below, while at the same time giving the herbage a firmer root-hold. Grass land that has been thoroughly harrowed will often be the better for rolling after wild white clover, lime and fertilizers have been distributed.

(To be continued)

SMALL HOLDINGS FOR UNEMPLOYED WORKERS: PROVISION OF COTTAGES

IN connexion with any scheme for the creation of small holdings by the State or by Local Authorities, the provision of cottages must play an important part. In order to carry out efficiently a scheme involving the erection of dwellings in rural areas, the building labour of the district must be utilized as far as possible. In these circumstances it is eminently desirable that the dwellings should be straightforward and simple to construct in order to combine the essentials of soundness and economy. It would also be a matter of regret if the dwellings were not attractive—or at least inoffensive—with some affinity to the character of traditional cottage design of their several districts.

To demonstrate the possibility of fulfilling these requirements two types of cottages, giving minimum (but not pinched) accommodation, that are suited respectively to south-east and north-west England, are here described and illustrated. The districts mentioned are broadly the divisions in which steep-pitched tile roofs and low-pitched slate ones are respectively traditional; from these controlling facts arise the characteristic internal forms usual to each area. In both cases the cottages might be built with normal materials, by local builders (after tendering in competition), at a cost of approximately £400 each, and such prices have actually been obtained.

The lowest tender for the two gabled detached cottages illustrated (Figs. 1 and 2), inclusive of drains, water supply and paths, was £820. These south-country cottages were built for workers on the field station of the Institute of Agricultural Parasitology at Winches Farm, between St. Albans and Hatfield. They are of brick with hand-made sand-faced tile roofs and weather-boarded gables; the rooms are of reasonable size and pleasant shape; and the inclusion of one bedroom on the ground floor enables this to be made use of as a sitting-room should fewer than three bedrooms be actually required. Economy results from the simple shape, beam and joist upper floor permitting light scantlings and ensuring adequate roof tie by the first floor cross joists, small amount of external walling, and compact water service and drainage provision. Each room has a fireplace. The ubiquitous but unlovely Fletton brick is used for the walling, and the complications and uncertainties of cavity walls are eschewed, external walls being 9 in. thick, well tarred externally up to

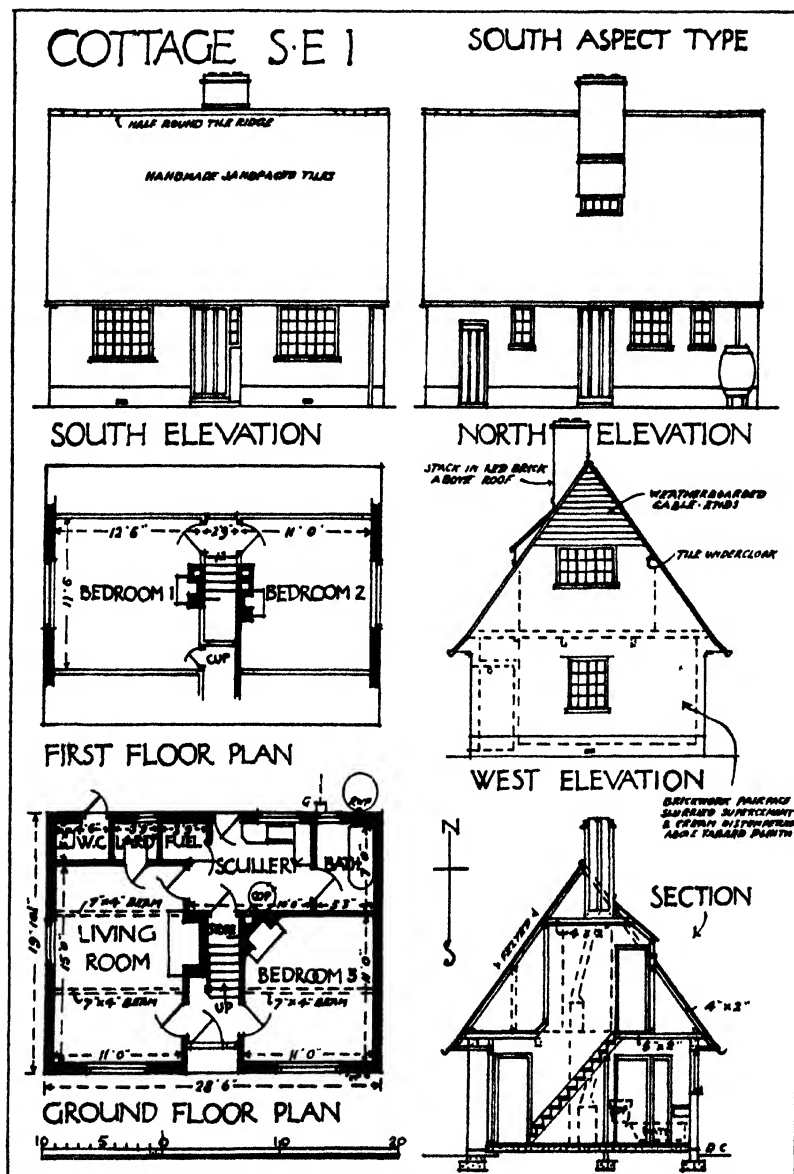


FIG. 1.

18 in. high, and slurried with super-cement distempered cream colour above. By this treatment the salmon-pink colour and harsh machine-made lines of the bricks are obscured, pointing is obviated, and a weatherproof face is given. Such cottages would not be out of place if erected anywhere east of a line joining the Wash and Southampton Water.



FIG. 2. Gabled, detached cottages in Hertfordshire.

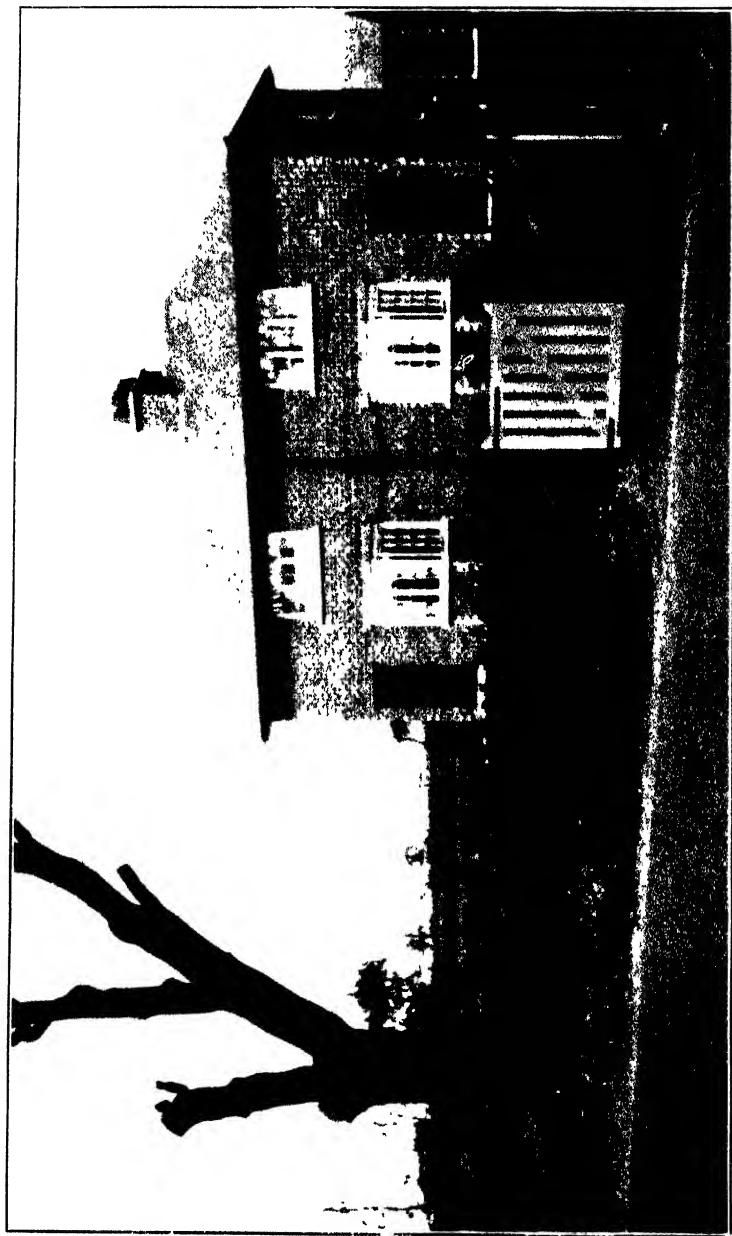


FIG. 4. Cottages on the Lathams' Estate, South Latham.

North and west of the above-mentioned line, cottages with flatter-pitched slated roofs are, speaking generally, more in accord with traditional character—usually a safe guide. Such cottages, to afford equivalent accommodation, need to be differently schemed, the three bedrooms being placed on the upper floor. In this form, when reduced to minimum limits and built singly, an unpleasant “pillbox” proportion is unavoidable; this may be overcome where it is possible to build in pairs, as in the example illustrated (Figs. 3 and 4) from the Lancashire County Council estate at South Latham. These excellent cottages, with a useful outbuilding comprising cart or packing shed and piggery, have been built in considerable numbers for £1,010 per double set, the cost of the actual single cottage, comprising the accommodation blacked in on the plans, being £445. This price includes a bay window and certain internal conveniences which would not be

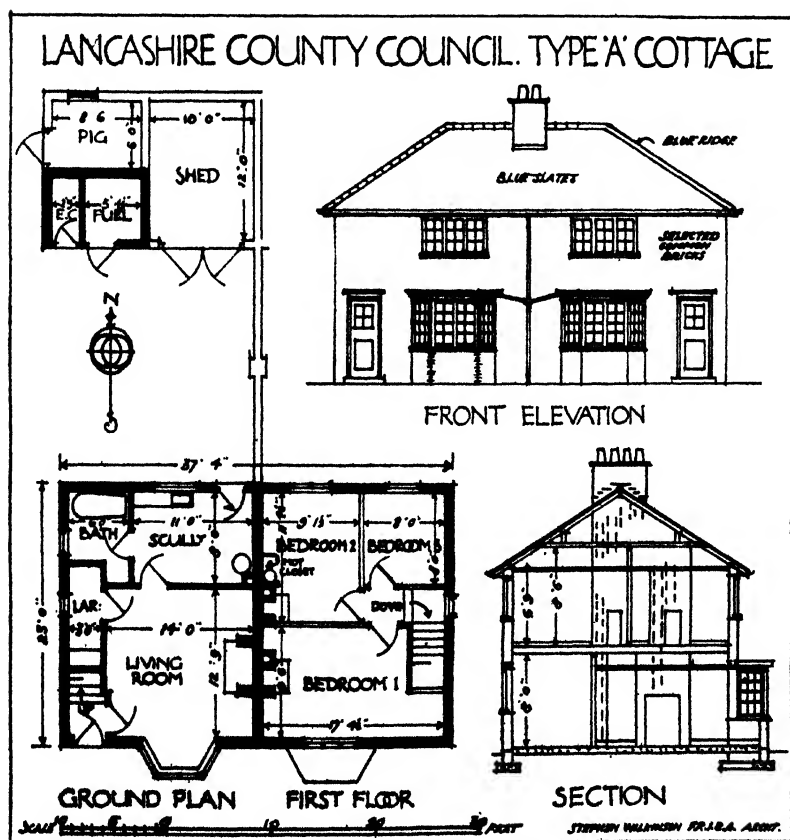


FIG. 3.

introduced where the maximum economy was necessary, the result being a cost that is practically identical with the southern type of cottage. This type might be built even in the beautiful west country—cream washed and with a roof of Cornish slate—without outraging local character.

* * * * *

THE WORKING OF THE SEEDS ACT, 1920, IN THE SEASON 1929-30

NINE years have now elapsed since the Seeds Act came into operation to replace, in permanent form, the temporary provisions that were brought into force during the War. Primarily, its object was to afford some measure of protection to purchasers. In so far as this has been achieved, it has not been based upon stringent measures to suppress the sale of the cheaper classes of seed of lower quality, but upon the broader lines of affording the purchaser as much information as is possible and necessary to enable him to choose between offers of seeds of different qualities. At the same time it has become increasingly apparent, with the passing of the seasons, that seedsmen, too, have gained by the existence of the Act. By requiring a clear statement of certain material particulars on or before sale or delivery, and rendering the seller who gives false particulars liable to punishment, it makes hard the path of the disreputable adventurer into the seed business, and so affords protection to the trade itself.

Licensed Seed Testing Stations.—Under the Act, the Official Seed Testing Station for England and Wales was set up at Cambridge. The results obtained at the Official Station may be used by any seller as the basis of the declaration that he is required to give to the purchaser. In addition, the Minister is empowered to license private seed-testing stations, and there are at present some 82 of these, belonging to seed firms, which are licensed to test for the purpose of their own declarations. The number is one less than at the end of the previous season.

Seeds of all kinds may be tested, for the purpose of the statutory declaration, at 32 of these private stations. The others hold restricted licences, most of them permitting the testing of cereal seeds only. It is obvious, however, that the accuracy of the results obtained by all of them is a matter of fundamental importance, especially as the firms possessing their own stations include some of the leading seedsmen in the country, and form the "bottle-neck" through which distribution is largely effected.

The inspection of private, licensed seed-testing stations has remained in the hands of two Inspectors, who have visited each of the more important ones several times during the season. These stations are required to retain for a period a "Reserve Portion" of each sample of seed tested, and 1,310 of these Reserve Portions have been taken for check testing at the Official Station. As usual, attention has been drawn to any serious discrepancies disclosed by these tests. In addition, there have been issued to each station twice during the season a series of three "Referee" samples, taken from selected bulks, in order that a comparison might be made between the testing results obtained by licensed stations and by the Official Station on samples as nearly as possible identical. The general position, as shown by these two forms of control, was discussed at the Conference of Seed Analysts, held towards the close of the season, and mentioned subsequently in this report.

Visits to Seedsmen.—Most of the routine work in the administration of the Act takes the form of visits paid by Inspectors to the premises of seedsmen to ensure that they understand and carry out the obligations that are imposed upon them. During the year some 6,370 calls were made, including 1,120 to sellers who had not previously been visited. These figures differ but little from those for the preceding year. It has been mentioned in earlier reports that one of the difficulties encountered is that of the trader whose main business lies in some other direction, but who takes up seeds as a side-line, probably for a short period in the year. Most of these sellers handle only packeted seed, but constant efforts have nevertheless been made to bring them under surveillance. The greater part of the time given to inspectional work, however, is spent among seedsmen in the usually accepted sense of the term, and it is worth recording that there is a fairly general consensus of opinion on the part of the Inspectors whose duties include making these calls, that they are, as a rule, not unwelcome visitors.

Visits to Farmers.—In conjunction with the inspection of seedsmen's stocks, the officers engaged on seeds work have continued their efforts to bring home to those farmers who sell seed the fact that they, too, are required to comply with the provisions of the Act. Where other duties bring Inspectors into touch with farmer-sellers, the opportunity is taken to explain the position to them. Rather more than a thousand

visits, wholly or partially on business connected with the Act, were made to farmers during the season.

Control Sampling.—During the course of their visits, Inspectors take each season a number of "control samples" for the purpose of checking, by means of a test at the Official Seed Testing Station, the particulars declared by the seller. Excluding some non-scheduled seeds, which are the subject of a separate paragraph below, the actual number of control samples thus taken was 1,796, or about 70 more than last year. They included 369 samples of clover, 217 of grasses, 24 of field seeds, 93 of sugar beet, 355 of other roots, 232 of vegetable seeds, 95 of cereals and 411 of packeted seeds. Leaving packeted seeds out of account for the moment, it was necessary to draw the attention of the seller to omissions or discrepancies in 121 cases. There were 16 instances of failure to declare the country of origin of grass or clover seeds ; 15 of omission to state the bushel weight of rye-grass ; 35 of declarations either incomplete in some other respect or omitted altogether ; and one case in which the seller based his statement on his own unauthorized test. The remaining 54 cases all disclosed discrepancies in either purity or germination, and included 7 samples of grass seed, 25 of clovers, 13 of roots and 9 of vegetables. Of these, 17 showed variations between the declared purity and that found in the check analysis, 5 of them of less than 3 per cent., but 9 of more than 5 per cent. The other 37 cases were of germination discrepancies, 18 of which were of less than 10 per cent. (and, therefore, not far outside the permissible limits of variation), 10 of more than 10 per cent. but less than 15 per cent. and 9 of more than 15 per cent. To sum up in a few words the position as regards non-packeted seeds, nearly 7 per cent. of the samples taken gave rise to correspondence with the seller—1 per cent. of them by reason of a difference as to the purity of the seed, 2 per cent. on account of the germination, and the remaining 4 per cent. because of some other matter, such as the omission of other statutory particulars.

Packeted Seeds.—The tendency for the trade in packeted seeds to become more and more concentrated in the hands of large and reputable firms still continues. It is common to find that retailers hold agencies for one or other of a small number of well-known houses and stock their packets on the "sale or return" system. The result is, of course, to reduce the practice of holding over a few remaining packets from season to season and so to lessen the possibility of seed of

low germinative power being sold to the small customer. The samples of scheduled seeds in packets taken during the season numbered 411. There were a few cases of discrepancies in purity and of incomplete declaration on the packet, but mis-statements as to germination occurred in only 3·5 per cent. of the total, showing a noticeable improvement even upon the figures for the previous season.

Non-Scheduled Garden Seeds.—From time to time the suggestion has been made that, for the protection of home gardeners and allotment-holders in particular, the salad seeds in common use should be brought within the scope of the Act. In order to obtain some precise information as to the quality of seeds of this kind offered to the public, small purchases were made over the counter in many parts of the country. The seeds purchased comprised 31 samples of lettuce, 24 of celery, 25 of leek, 21 of spinach and 27 each of radish and parsley.

A few poor samples, consisting no doubt of old seed, were found, but generally speaking the tests showed the seeds to be satisfactory.

Seed Analysts' Conference.—The Eighth Conference of Seed Analysts took place at the Official Seed Testing Station on July 25, 1930, with Sir A. D. Hall in the chair.

The Chief Officer of the Station reviewed in some detail the results of testing the two series of "Referee" samples that had been circulated to licensed stations during the season. These had consisted of white clover, cocksfoot and mixed rye-grasses, followed by carrot, sugar beet and tares. Although the results showed room for improvement in certain respects, the Chief Officer thought that, on the whole, the analysts at the stations were to be congratulated on the measure of uniformity attained. At a subsequent stage of the meeting, the Chief Officer referred to a number of points which had arisen during the season's work, including the identification of heated samples, weevils in seed peas, dodder in flax, the effect of dressings on the germination of sugar beet seed and the test period for carrot seed.

Professor S. P. Mercer, of the Northern Irish Official Seed Testing Station, read a paper on work that has been conducted on the identification of rye-grasses by means of ultra-violet light.

Training and Examination of Seed Analysts.—The ninth course of instruction in the principles and practice of seed testing was held at Cambridge during June and July. Eleven

analysts took the course and all sat for the examination. Only one candidate failed to satisfy the examiners. The standard of efficiency shown in the written papers was said by the examiners to have been higher than for several years past.

Seed Analysts' Bulletin.—Two issues of this Bulletin were prepared and circulated during the year. As usual, the full results obtained from the examination of "Referee" samples were tabulated and discussed; some particulars were given of seed control in Scotland, the Irish Free State and other parts of the world; attention was drawn to new import regulations imposed in certain of the Dominions and foreign countries, and articles were included dealing with the English wild white clover certification scheme, and with a number of other matters of interest to seed analysts.

Testing of Seeds for Export to the Dominions.—Towards the end of 1926, an arrangement was made whereby the cost of testing, at the Official Station, seeds for export to certain of the overseas Dominions should be met out of a grant from the Empire Marketing Board. There was, of course, no intention that this arrangement should be of a permanent character, but it was hoped that the financial assistance thus afforded would enable seedsmen at home to obtain a foothold in, at least, certain sections of the inter-Empire seed trade. It has been usual, in making grants of an experimental though commercial nature, to limit their operation to a period of three years, and a decision has now been reached that the grant in this case must cease at the end of July, 1931. The number of samples tested under the scheme during the seed year 1929-30 was 1,209, consisting mainly of vegetable and pulse seeds, but including also grasses and clovers, mangolds and beet, and a few samples of cereal seeds.

Seed Potatoes.—It was necessary to institute inquiries in 31 cases where the statutory requirements relating to the sale of seed potatoes seemed to have been infringed. Of these 19 related to apparent mis-statements as to variety and 8 to size and dressing, while in 4 instances the declaration was incomplete. Twenty of these cases were reported to the Department of Agriculture for Scotland, as relating to seed potatoes of Scottish origin, and prosecutions were instituted in three instances, a conviction being recorded in each one. The fines imposed were £5 in two cases and £3 in the other. In addition, the Scottish Department issued a warning to sellers in 11 instances. No English seller

of seed potatoes was prosecuted during the season, though warnings were given on three occasions.

The enforcement of the law in respect of seed potatoes is rendered difficult by reason of the fact that a great many greengrocers and other traders undertake the sale of seed potatoes during a short period of the year. Every reasonable effort is made to bring these casual sellers into line with regular seedsmen, and a single-sheet instruction has been prepared to help them to understand just what is required of them by the Act.

Prosecutions.—Only two prosecutions were taken under the Act during the season. In one case a firm at Montgomery was proceeded against and fined £2 for failing to give the necessary particulars on the sale of swede seed ; and in the other a merchant at Uppingham was prosecuted and fined £1 for making a false statement as to the percentage germination of swede seed.

General.—Copies of the Seeds Act, 1920 (price 3d. net) ; the Seeds (Amendment) Act, 1925 (1d. net) ; and the Seeds Regulations, 1922 (3d. net), may be obtained, either directly or through any bookseller, from His Majesty's Stationery Office, Adastral House, Kingsway, London, W.C. 2. A leaflet explaining the purpose and effect of the Act, and giving information as to how to obtain tests of seeds, may be obtained, free of charge, from the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.

OYSTER SHELL AND COCKLE SHELL FOR POULTRY

J. AUGUSTUS VOELCKER, C.I.E., M.A., B.Sc., Ph.D.,
Consulting Chemist, Royal Agricultural Society of England.

At various times, I have had submitted, for analysis, samples of oyster shell and of cockle, scallop and similar shell, and have been asked what is the difference between them, and what there is to account for the fact that, while the former is in high favour among poultry keepers and is considered indispensable, the latter obtain neither favour nor sale. Analyses failed to discover anything in the one or the other which, on chemical grounds, would account for the difference. As they were found to be practically equally rich in the constituent, carbonate of lime, for which they are mainly used, viz., to ensure the production of a firm shell, one wondered how far the preference for oyster shell was based purely on "fancy" and on judicious exploitation of its virtues, and how far on actual fact.

Possibly, there might be some difference between the two, in respect of the mechanical condition and state of aggregation, which might occasion what chemical analysis did not reveal. Anyhow, it seemed well to put the question to the practical test, and, for that purpose, I enlisted the help of a friend, himself well known as an authority on poultry matters, and accustomed, by long experience, to the carrying out of reliable investigations.

At the outset, it was found that, whereas there is a ready demand and good sale for oyster shell at from £5 to £5 7s. 6d. a ton, and that it is brought over to this country from America, cockle, scallop and similar shell lies accumulated at many places on our shores and finds a use practically only as material for making garden paths, but not for feeding poultry.

In the course of inquiries made, it was ascertained that, for example, on the Essex coast, at the present time, cockle shell, as it lies in the heap, can be obtained at 3s. per ton, or 8s. a ton put on rail, as against the £5 or more per ton realised from the sale of imported oyster shell. It is true that, when it does find its way to sellers of poultry food, it is occasionally met with as an adulterant of oyster shell, and, if asked for by itself, will be charged at from £4 to £4 5s. a ton. In one case (Essex), whence the two materials were sent for comparison, the relative prices quoted were: oyster shell, 7s. per cwt. delivered; cockle shell, 4s. per cwt. delivered. In another instance (Devonshire) the quotations were: oyster shell, 6s. per cwt.,

cockle shell, 4s. 9d. per cwt. Speaking generally, it may be said that there is a difference of from £2 to £2 10s. a ton in price between the two.

There remains the fact that cockle and similar shell is not in favour with poultry-keepers, the majority of whom will have nothing whatever to do with it, but declare that poultry will reject it while they will eat oyster shell greedily. Encouragement to this belief in the vast superiority of oyster shell is naturally given by the importers, and circulars relating to it warn purchasers against buying shell that attracts rats, contains salt that rots the bags, and that has fibre, dirt and other impurities with it. Other virtues of oyster shell are claimed, and, in particular, the fact of its being of a firm, flaky character and not lumpy or crumbly, as well as its being kiln-dried and free from excess water. It was to test the value of these assertions that the experiments here recorded were undertaken.

The first step was to analyse samples of each kind of shell, and the results obtained are shown in Table I.

TABLE I

			<i>Oyster Shell</i> per cent.	<i>Cockle shell</i> per cent.
Carbonate of lime .. .. .	..	..	96.91	96.40
Siliceous matter .. .. .	..	..	.14	.49
Moisture, &c. .. .. .	..	..	2.95	3.11
			<hr/> 100.00	<hr/> 100.00

There was nothing in these figures to suggest any ground for the superiority of oyster shell. Both were, to all intents, carbonate of lime, and practically equally rich in this constituent, one that is recognised as necessary for successful egg-laying. Unless there were some virtue in the particular state of aggregation of the carbonate of lime in the case of the oyster shell, or some difference in the mechanical condition of the respective materials, it was difficult to see why there should be any difference in their use, or reason for the preference generally given to the dearer material.

First Experiment.—The experiment was carried out, in the first instance, for a period of nine weeks, February 13 to April 17, 1930. Fifty-five Wyandotte hens were placed in a pen, and these, as any of them became "broody," were replaced by other hens.

At the outset, the hens were fed for the first week with oyster shell only added to their usual food, which included 4 lb. of flint grit to the pen per week. Four pounds of oyster shell were used to the pen for the week, at the end of which

time the quantity consumed by the birds and that left unused were noted. The following week the oyster shell was partly replaced by cockle shell, the quantities consumed and left being noted, as before. Each week the amount of oyster shell was further reduced and that of cockle shell increased, until, in the ninth week, cockle shell had been entirely substituted for oyster shell.

Table II gives the amounts of each kind of shell given per week to the 55 birds, and the amounts of each consumed or left to be picked up :—

TABLE II.

	Week	Shell given			Shell consumed		Shell unconsumed taken away	
		Oyster lb.	Cockle lb.	Total lb.	Oyster lb.	Cockle lb.	Oyster lb.	Cockle lb.
(1) Feb.	13-20	4	0	4	2	—	2	—
(2) „	20-27	3½	½	4	mixed		mixed	
(3) „	28-Mar. 6	3	1	4	2½	1½	1½	1½
(4) Mar.	6-13	2½	1½	4	3	„	1	„
(5) „	13-20	2	2	4	3	„	1	„
(6) „	20-27	1½	2½	4	3	„	1	„
(7) „	27-Apr. 3	1	3	4	3	„	1	„
(8) Apr.	3-10	½	3½	4	2½*	„	1½	„
(9) „	10-17	0	4	4	2½*	„	1½	„

* The hens were not laying so well at these periods, which may account for the rather lower amount of shell consumed.

The birds did quite well throughout the period, and in no case was there any complaint of “soft shell” with the eggs. When, after the first week, the change from oyster shell to a mixture with cockle shell was made, the birds were noticed to pick out the brighter and more shiny particles of oyster shell, but, this done, they went on to the rest quite satisfactorily, and, in the end, as the above table shows, consumed the cockle shell just as well as they had done the oyster shell alone. There is no reason, accordingly, for considering that the oyster shell is superior, or that the difference in price between the two materials is justified.

Second Experiment.—At the conclusion of the above trial a further experiment was made. Two separate pens of birds were taken, the one—as additional food—receiving oyster shell only, and the other pen cockle shell only, and, as before, noting the amounts of each kind of shell consumed.

Again, about 50 Wyandotte hens were placed in each of two pens, and to the one pen oyster shell only was given as an addition, and cockle shell only to the other—the relative

amounts consumed and left to be picked up being noted. Four pounds of grit per week was, as before, given to each pen.

This experiment was carried on for five weeks, and the returns obtained are given in Table III.

Week	TABLE III				<i>Shell</i>	
	<i>Total put down each week</i>		<i>Shell con- sumed</i>		<i>unconsumed taken away</i>	
	Oyster lb.	Cockle lb.	Oyster lb.	Cockle lb.	Oyster lb.	Cockle lb.
1930						
(1) Apr. 17-24	4	4	2½	2½	1½	1½
(2) „ 24-May 1	4	4	2½	3	1½	1
(3) May 1-8	4	4	3	3½	1	½
(4) „ 8-15	4	4	3	3	1	1
(5) „ 15-22	4	4	2½	2½	1½	1½
Total	20	20	14½	15	5½	5

From these results, it will be seen that the lot receiving cockle shell only took just as much as did the lot on oyster shell. Moreover, there was no apparent difference in the health or well-being of the two sets, and no complaint about the eggs and their shells.

Conclusion.—It is clear from these trials that, when birds have become accustomed to the use of cockle shell, they will take it just as well and freely as they will oyster shell, and that, as the relative analyses would indicate, there is no practical difference between the two as a source of lime, either as regards the health of the birds or the nature of the eggs. Hence, the preference generally accorded to oyster shell must be put down merely to “fancy,” and to advocacy of the more costly material. The conclusion to be drawn, therefore, is that the cheaper material—cockle shell—will answer the purpose quite as well as oyster shell.

MARKETING NOTES

National Mark Eggs.—During the 11 months, January–November, 1930, the output of the authorized packing stations amounted to 205 million eggs, of which 147 million were packed under National Mark labels. During the four months, August–November, the total output of the packing stations was greater by 20 per cent. and the National Mark output by 35 per cent. than during the corresponding four months of last year.

Keen interest continues to be shown in the scheme, and of late more inquiries have been received from all parts of the country. Some of these seem likely to lead to the organization of packing centres in localities that are not at present served by the scheme.

A report has recently been received on two auctions held in the same town in the south of England, at one of which eggs were being sold by a National Mark egg packing station, while, at the other, ungraded supplies were on offer. The appearance of the National Mark packs and the ease and speed with which they were disposed of were very striking by comparison, and an object lesson to both producers and buyers of the value of standardization in marketing. Good prices were made for the National Mark eggs, whilst comparatively poor prices were received for the ungraded supplies.

Under the conditions attaching to the scheme, every National Mark label applied to a package of eggs (other than a carton holding 1 doz. or $\frac{1}{2}$ doz. eggs) must bear a code mark indicating the date of packing. It is required that the code mark shall be over-stamped in black in the left-hand bottom space of the label, below the grade designation, and the letters must be $\frac{3}{8}$ in. in height. A check slip in the form authorized by the Ministry must also be placed inside each container so labelled, bearing both the date of packing and the code mark corresponding to that appearing on the outside of the case. This arrangement will continue during 1931, and a code-dating calendar for that year has been prepared. Copies of the calendar may be obtained on application to the Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W.1.

National Mark Dressed Poultry.—Although this scheme is still in the experimental stage, about 16,000 head of dressed poultry were marketed under National Mark labels during the first six months from its inception on June 2, 1930. Slightly increasing supplies are now coming forward.

Inquiries from producers and packers continue to be received, and further applications for authorization to apply the National Mark are anticipated in the near future.

National Mark Beef.—The weekly average number of sides (including quarters and pieces expressed in terms of sides) of beef graded and marked with the National Mark during December, 1929, and November, 1930, and the number of sides graded and marked for the four weeks ended December 13, 1930, were as follows :—

LONDON			<i>Number of sides</i>
Weekly average—	Dec., 1929	1,198	
" "	—Nov., 1930	2,026	
Week ended	— " 29, 1930	2,126	
" "	—Dec., 6, 1930	2,221	
" "	— " 13, 1930	2,353	
BIRKENHEAD*			
Weekly average -	Dec., 1929	254	
" "	—Nov., 1930	996	
Week ended	— " 29, 1930	634	
" "	—Dec., 6, 1930	744	
" "	— " 13, 1930	986	
SCOTLAND*			
Weekly average—	Dec., 1929	1,371	
" "	—Nov., 1930	1,999	
Week ended	— " 29, 1930	1,904	
" "	—Dec., 6, 1930	2,352	
" "	— " 13, 1930	2,420	
TOTAL LONDON SUPPLIES (All sources)			
Weekly average—	Dec., 1929	2,823	
" "	—Nov., 1930	5,021	
Week ended	— " 29, 1930	4,664	
" "	—Dec. 6, 1930	5,317	
" "	— " 13, 1930	5,759	
BIRMINGHAM			
Weekly average—	Dec., 1929	442	
" "	—Nov. 1930	464	
Week ended	— " 29, 1930	469	
" "	—Dec. 6, 1930	546	
" "	— " 13, 1930	486	

* Sides consigned to London.

The total number of sides of beef graded and marked during November, 1930, was the highest for any month since the introduction of the scheme, both for London and for Birmingham, and forms striking evidence of the hold that the National Mark Beef Scheme has now obtained in the trade in both these areas.

The continuation of the National Mark Beef Scheme in the London and Birmingham areas until October 31, 1931, has been authorized, also the extension of the scheme to the Leeds and Bradford areas, and to towns in South Wales, for a period of twelve months. This was recommended by the Inter-Depart-

mental Committee on the Grading and Marking of Beef, whose Report* should prove of considerable interest to producers and distributors. It is hoped to introduce the National Mark Beef Scheme in the Leeds-Bradford area towards the end of January, 1931.

National Mark Apples and Pears.—The total number of authorized packers in the Apple and Pear Scheme is now 93 for apples and 18 for pears.

The following is a list of growers who have recently been authorized :—

APPLES

- Cambs :* Ayers & Son, Elm, Wisbech.
B. N. Doubleday, Upwell, Wisbech.
Hickman & Co. (Wisbech), Ltd., Leverington, Wisbech.
Hopkins & Morton, Kentmere, March.
- Cheshire :* H. C. Groom & Co., Bellevue Farm, Guilden Sutton, Chester.
- Devon :* S. B. Neill, Sunnyhaye Fruit Farm, Woodbury Salterton, Exeter.
- Essex :* T. B. Douglas, Stratton, Hatfield Peverel, Chelmsford.
W. Lawrence, Fruit Farm, Ashdon, Saffron Walden.
H. C. Stone, Thanet Grange, Prince Avenue, Southend-on-Sea.
M. Swan, The B.X. Ranch, Little Totham, Maldon.
W. L. Taylor, Galleywood, Chelmsford.
- Hunts :* E. H. Harrison, The Shrubbery, St. Neots.
- Kent :* S. E. Foreman, Summer Lees, Hernhill, Faversham.
Major J. H. Gill, D.S.O., Foxglove, Willesborough, Ashford.
- Notts :* T. R. Jeffcock, Welham Cottage, near Retford.
- Salop :* E. Nicholls, Weeping Cross, Cross Houses.
- Somerset :* Norton-sub-Hamdon Fruit Farm, Norton-sub-Hamdon.
Smith and Underwood, Street.
- Suffolk :* Miss M. B. Amos, The Fruit Farm, Beyton, Bury St. Edmunds.
- Surrey :* Lieut.-Col. S. R. Normand, Manor Lodge, Stoughton, Guildford.
- Worcs :* J. A. Southall, Offenham, Evesham.
W. F. Swift, Fladbury, Pershore.

PEARS

- Cambs :* Ayers & Son, Elm, Wisbech
Hopkins & Morton, Kentmere, March.
- Cheshire :* H. C. Groom & Co., Bellevue Farm, Guilden Sutton, Chester.
- Essex :* T. B. Douglas, Stratton, Hatfield Peverel, Chelmsford.
- Kent :* East Malling Research Station, East Malling.
- Norfolk :* Colonel B. J. Petre, Westwick Fruit Farms, Westwick, Norwich.
- Worcs :* D. Blore, Craycombe Farm, Fladbury, Pershore.

Authorized packers are required to indicate the date of packing on packages containing National Mark apples and pears. For this purpose, packers, if they so desire, may substitute a code date on the National Mark label for the actual date. The code date, when used, must be over-stamped in black upon the National Mark label in the place provided, the letters being $\frac{3}{8}$ in. in height.

* Cmd. 3648.

This arrangement will continue during 1931; code-dating calendars may be obtained on application to the Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W.1.

National Mark Tomatoes and Cucumbers: A Review of Progress.—The National Mark Scheme was applied to tomatoes and cucumbers in 1929, largely at the request of growers' representatives. The grade standards prescribed, and the regulations laid down as to packages and packing, follow closely those established by the British Glasshouse Produce Marketing Association.

Authorization of Packers.—In the first season, 78 growers were authorized for packing tomatoes and 24 for cucumbers. For a variety of reasons, the development of this scheme has not been so notable as in the case, for example, of the apple and pear scheme. In the first place, there are a number of growers with a very large output who have established private marks and a reputation for consistent grading; some of these growers have remained outside the scheme, and, by their example, they have influenced smaller growers to do the same. Others have failed to appreciate the necessity for strict compliance with the grade standard, or have desired a standard that would vary with the fluctuating condition of the crops. Some have been deterred by the cost of labels and the cost of pasting labels on the boxes. Despite these factors, however, a further 11 tomato growers and 7 cucumber growers were authorized during 1930, making, in all, 89 authorized packers of tomatoes and 31 of cucumbers.

Quantities Marketed.—It is impracticable to obtain precise figures as to quantities of tomatoes and cucumbers marketed under the Mark, but the tomato scheme, at any rate, has made substantial progress, and there is no doubt that large quantities of National Mark tomatoes have reached the markets.

The quantity of National Mark cucumbers marketed has been relatively small, even with packers who have given the scheme full support. There are several reasons for this. With early crops, the proportion of cucumbers that fall within the National Mark grades is small, prices are high and buyers are not critical as to shape. Growers therefore find it more remunerative to pack below National Mark grade. Again, in the last two seasons, a large proportion of cucumbers have lacked the bright-green colour required by the scheme, and authorized packers have not been able to apply the Mark to that part of their output. They naturally feel that the withholding of the Mark gives buyers an impression that the un-

marked packs are much more inferior in quality than is actually the case. The edible quality of a cucumber bears little or no relation to its colour, but colour, nevertheless, is an important factor in selling; the average consumer prefers a bright-green cucumber. Objection is taken also to the exaggerated impression of inferiority given to unmarked packs that are just below National Mark grade in straightness and shape. No satisfactory suggestion for dealing with these matters has yet been made.

Distribution.—Most National Mark tomatoes from the Lea Valley area have been placed in the Midland and Northern markets, a relatively small proportion only coming on the London markets. Those from the Worthing district have been divided between the London markets and the south-coast towns. Provincial growers generally have placed their supplies in neighbouring towns. A very small proportion of purely local trade has been developed, but as the scheme does not at present offer immediate advantages where the producer sells directly to the retailer, development in this direction is uncertain.

Grading.—Inspection of supplies on packers' premises and in wholesale markets has shown that the grading of National Mark supplies, on the whole, has been satisfactory. Contraventions by six of the packers of tomatoes have been reported this year, and all but two of these were obviously due to lack of supervision of the packing operations. The improvement in the grading of tomatoes marketed by growers not using the Mark is most noticeable; several have stated that they are grading to National Mark standards, but do not apply to become authorized packers because they fear the effect of an adverse report should a few off-grade packages slip through under the Mark. There has been a definite and general improvement in the grading of cucumbers.

Packages.—Although a number of types of packages are authorized, the scheme has been practically confined to the non-returnable 12-lb. tomato box and the two-layer cucumber box. There is a definite reluctance to use the National Mark on tomato strikes and cucumber flats.

Labels.—The cost of National Mark labels seems to have had a deterrent effect upon some packers. The costing of labels is, therefore, being reviewed. Suggestions have been made (i) for incorporating a small National Mark with the grower's own label, (ii) the use of a small, gummed label to place on the grower's own label, and (iii) for a National Mark rubber stamp. To meet the views of many packers, the space

for the grower's name or mark has been enlarged, but it must be pointed out that if the full benefits of the National Mark Scheme are to be obtained and a basis for national advertising established, the National Mark on the label must be paramount and National Mark labels must be uniform for all packers.

The cost of pasting labels on boxes is also a source of complaint. Where ready-branded boxes have been used previously, it is an added cost that is irksome. In the marketing of almost all commodities, however, the use of printed or branded wood is being abandoned in favour of attractive coloured labels, and it would be a retrograde step to adopt branding because of the slight extra cost of the label and pasting. A bright and attractive label is undoubtedly an important factor in selling.

National Mark Strawberries.—Applications for enrolment in the National Mark Scheme for strawberries are still being received, and an important increase in the number of authorized packers may be anticipated next season.

The use of a new container (Deep No. 2 Climax chip basket) has been approved for packing strawberries under the Mark. This basket is capable of holding 2 lb. of fruit with greater ease, and with less risk of the berries being crushed, than the ordinary Climax chip.

National Mark Canned Fruit, Peas and Beans.—Displays of National Mark canned fruit continue to be a feature in grocers' shops, large and small, throughout the country. The popularity of the produce has been striking, and supplies are rapidly becoming depleted. Some authorized canners with large outputs report that they are completely sold out of certain varieties, and the anxiety of wholesalers to secure adequate supplies is shown by reports that contracts have been made to take the whole output of authorized canners for several years ahead.

Proposals to include additional varieties of fruit and vegetables in the scheme during 1931 are now under consideration.

National Mark Wheat Flour.—The following firms have been enrolled as authorized re-packers of National Mark flour:—

Alderton, Ltd., 2 Malton Street, Plumstead, S.E. 18.

Baldwin Flour Co., Blackburn, Lancs.

Hathway & Hillier, Lyneham, Wilts.

E. Patchell, High Street, Aylesford, Kent.

A. H. Rayward & Sons, High Street, East Grinstead, Sussex.

The cookery competitions that it is proposed to hold under the auspices of the National Federation of Women's In-

stitutes should do much to stimulate interest in National Mark flour in rural areas. Already numerous inquiries have been received for the names of wholesale and retail suppliers, and it is hoped that many more names of grocers and bakers will soon be added to the list of authorized re-packers. Any re-packer who packs and sells a minimum quantity of 10 cwt. of flour of all kinds per week, or who can produce evidence that during a period of six months before application he has purchased not less than one sack (280 lb.) of National Mark flour for re-sale, is eligible to apply for authorization in the scheme.

The Director of the National Bakery School, reporting on the bread-making tests carried out on behalf of the Ministry with representative samples of National Mark (Yeoman) flour from wheats of the 1930 crops, states that all the flours were of a good average standard and more uniform than in previous years. Good "oven-bottom," crusty bread (other than cottage) of excellent appearance, texture, flavour and keeping quality was baked by a simple process that has now been described in leaflet form (Marketing Leaflet No. 12E) for the guidance of bakers and others interested. Copies may be had on application to the Ministry.

National Mark Malt Products.—The demand for pharmaceutical malt extract with cod-liver oil is, to a large extent, governed by temperature and climatic conditions. The winter of 1929-30 was exceptionally mild, with the result that the sales of "malt and oil" of all kinds were considerably below normal; similar conditions obtained in the autumn of 1930. One important effect of the scheme has, however, been to encourage the use of home-grown malting barley to a far greater extent than would appear from a consideration of the quantities of malt products actually marketed under the National Mark. Some of the largest manufacturers have decided to use home-grown barley only for all their products, whether or not bearing the National Mark, and the tendency in this direction will no doubt become more pronounced as the advantages of the scheme, with its insistence upon standard quality, become more widely known.

National Mark Cider.—The Minister has appointed a National Mark Cider Trade Committee to consider applications for permission to apply the National Mark to cider made from home-grown fruit, to make recommendations thereon to the National Mark Committee, to consider reports regarding the application of the National Mark by cider makers and bottlers,

and generally to advise the National Mark Committee and the Ministry in regard to the application of the Mark to cider made from home-grown fruit.

The National Mark Cider Trade Committee consists of :—

G. Stubbs, Esq., C.B.E., F.I.C., F.C.S. (Chairman).

Professor B. T. P. Barker, M.A., F.R.H.S.

The Hon. J. W. Best.

E. F. Bulmer, Esq.

R. H. Densham, Esq.

W. C. Gaymer, Esq.

A. Hole, Esq.

Sir Wm. Lobjoit, O.B.E., J.P.

J. H. Todd, Esq.

B. K. Welch, Esq.

S. Weston, Esq.

Mr. J. H. Gorvin, C.B.E., of the Ministry, is Secretary of the Trade Committee.

The Trade Committee, at its first meeting on December 4, decided to recommend the following manufacturers and farm makers for authorization under the Scheme :—

FIRST LIST OF APPLICANTS FOR AUTHORIZATION

London : H. & G. Simonds, Ltd., Plough Brewery, Wandsworth Road, London.

Berkshire : H. & G. Simonds, Ltd., The Brewery, Reading.

Devon.: Carr & Quick, Ltd., 16 Queen Street, Exeter (and at Topsham and Crediton).

Dartington Hall, Ltd., Skinners Bridge, Dartington, Totnes.

Edwin Hill & Son, Ltd., Staverton, Totnes.

H. & G. Simonds, Ltd., The Tamar Brewery, Devonport (and at Crabbs Park, Paignton (N. P. Hunt & Son)).

Schweppes, Ltd., Hele.

Dorset : Dorset Farm Cider Makers' Federation.

Gloucester : Severn Vale Cider Co., Ltd., Bushley, Tenterbury.

Schweppes, Ltd., Bledisloe Cider Mills, Blakeney.

Sydney Willetts, Blakeney.

Hereford : Bonner & Durrant, Holmer.

William Evans & Co. (Hereford and Devon), Ltd., Wide-marsh, Hereford.

R. E. Ridler, Clehonger Manor, Clehonger.

Watkins' Pomona Cider Co., Wye Bridge, Hereford.

H. Weston & Sons, The Bounds, Much Marcle, near Gloucester.

Middlesex : H. & G. Simonds, Ltd. (trading as Ashley's Staines Brewery, Ltd.), Staines.

The Taunton Cider Co., Ltd., 20-24 The Arches, South Harrow.

Somerset : R. N. Coate & Co., Ltd., Nailsea.

The Quantock Vale Cider Co., Ltd., North Petherton, Bridgwater.

Schweppes, Ltd., Weare.

Somerset Cider Apple Growers' and Farm Cider Makers' Federation, Tor Court, Glastonbury.

The Taunton Cider Co., Ltd., Norton Fitzwarren.

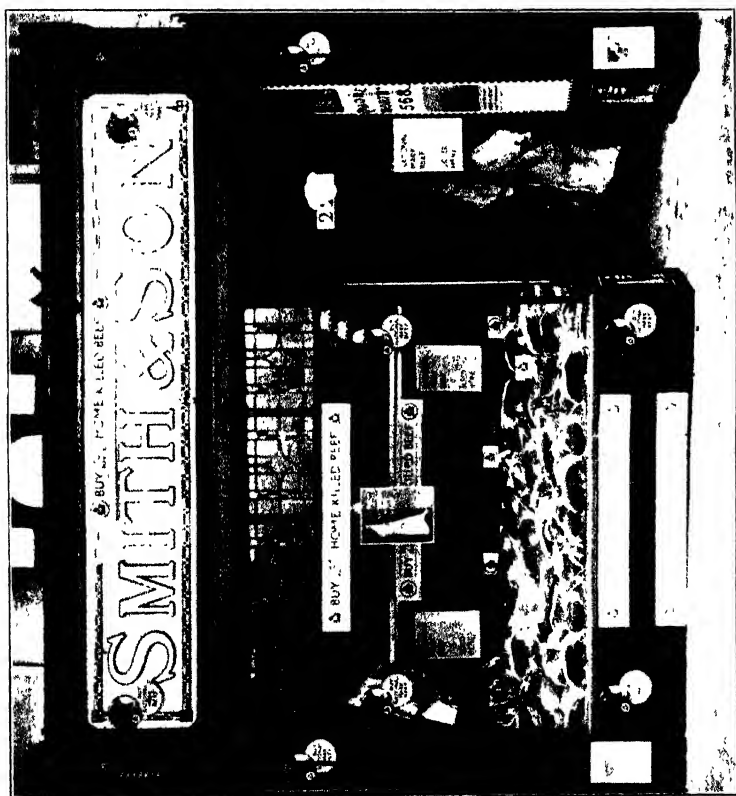
E. H. Wells (trading as "Lorna Doone Cider Vintage"), Ford Fruit Farm, Wellington.

The Committee also recommended that authorized makers should be permitted to apply the National Mark to stocks of cider made from previous seasons' apple crops, provided that satisfactory evidence be forthcoming to show that such cider is qualified for sale under the National Mark.

Publicity for National Mark Produce.—The Ministry's general programme of autumn and winter advertising was continued in December. The last two insertions in the series of advertisements in the national and chief provincial newspapers dealt with National Mark malt extract with cod-liver oil and National Mark canned fruits respectively, while a special Christmas appeal on behalf of National Mark beef was inserted in the London evening newspapers. Special advertising in newspapers circulating in the Eastern Counties was also continued, and the series was concluded shortly before Christmas. Advertising in trade journals covered National Mark beef, eggs, fruit, wheat flour, malt flour, malt extract with cod-liver oil, and canned fruits, peas and beans.

At the end of November, a personal letter from the Minister was sent to some 50,000 women householders in a part of south-west London, urging them to specify "National Mark" when purchasing any of the commodities referred to in the National Mark booklet, a copy of which was enclosed with the letter. Authorized packers of National Mark eggs, poultry, flour, canned fruits, and malt extract with cod-liver oil were notified of the dispatch of the letters, and also local butchers who regularly stock National Mark beef, grocers, dairymen, fruiterers and chemists. It was suggested to the local retailers that the Minister's letter provided a good opportunity to make special displays of National Mark products, for which liberal supplies of display material were offered.

At the beginning of December, a personal letter from the Minister was also sent to some 15,000 women householders in the Yardley Division of Birmingham, together with a copy of the National Mark booklet and an attractive new leaflet on the subject of National Mark beef, containing recipes for using up a joint of beef. The letter had special reference to National Mark beef, which, by means of press publicity and in other ways, was again well advertised in Birmingham during December. The press advertisements gave prominence to the window-dressing competition—reference to which was made in the December issue of this JOURNAL (p. 915). This competition was organized in four groups, on a district basis,

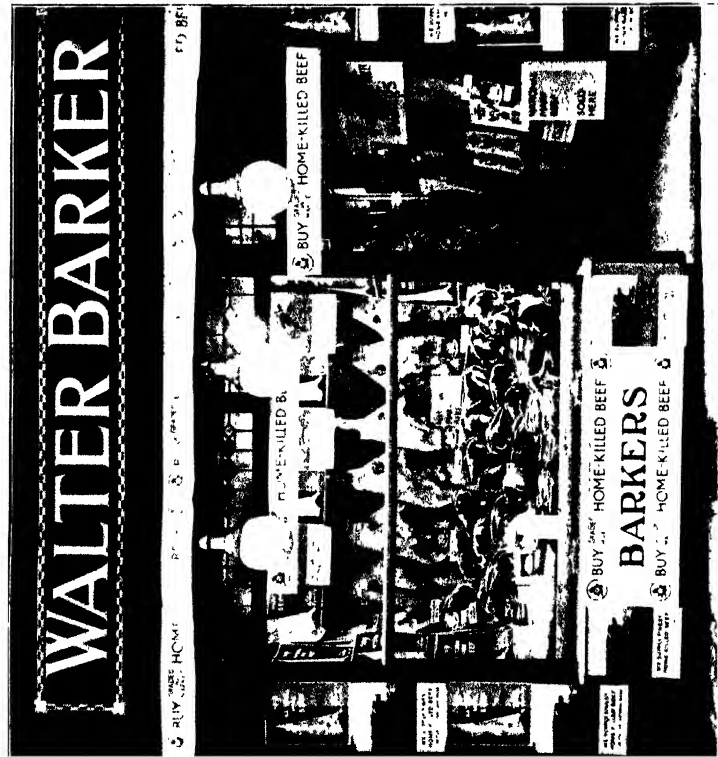


Group 1. Messrs G. A. Smith & Sons, Handsworth

NATIONAL MARK BEEF, First Prize Window Displays at Birmingham.

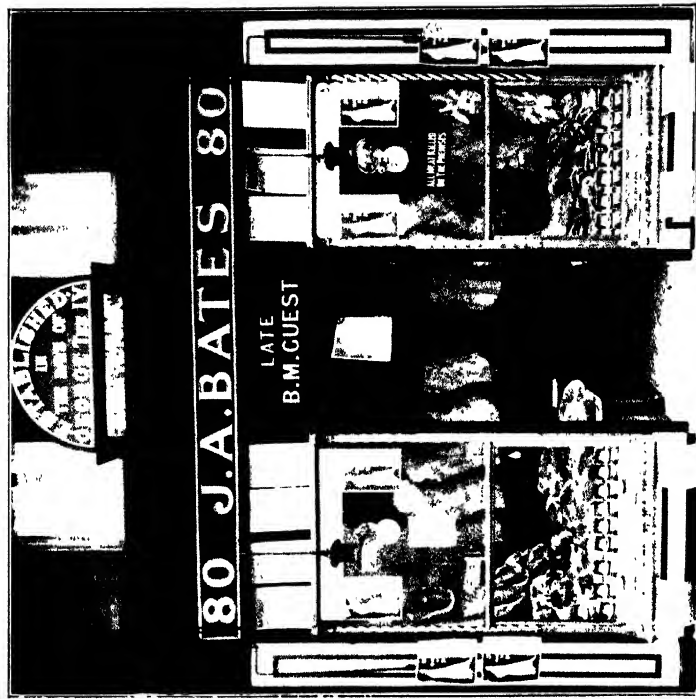
Group 2. Mr. F. W. Wright, Moseley.





Group 3 Mr. Walter Barker, Saltley

NATIONAL MARK BILL FIRST PRIZE WINDOW DISPLAYS AT BIRMINGHAM



Group 4 Mr. J. A. Bates, Bristol Street, Birmingham.

and was open to retail butchers who had regularly stocked National Mark beef for at least four weeks immediately before the competition. While the total entry (46) was not large, the competition proved a distinct success. The judges stated that the general standard of the exhibits was exceptionally high and rendered the judging difficult. They were impressed by the particularly attractive appearance and general high quality of the beef displayed, and considered that the competition as a method of encouraging consumers to appreciate high class, home-killed beef had certainly served its purpose.

The scale of points on which judging was based was as follows :—

General display and quality of National Mark Beef	40 points
Technical skill in cutting and the attractive presentation of joints	30 „
Display of appropriate posters and other advertising matter	30 „

Prizes of £20, £10 and £5 were awarded for the three best entries in each of the four groups, together with a number of prizes of £1 each. Photographs of the displays which received the first prizes are reproduced in the accompanying illustration inset. The three winners in each group and date of the group competitions were as follows :—

Group 1.—(North-Western Area) : November 26.

Judge : Councillor R. E. Probert, of Wolverhampton.

1st : G. A. Smith & Sons, 224 Soho Road, Handsworth.

2nd : E. T. Barker, 464 Bearwood Road, Smethwick.

3rd : Walter Smith, 524 Bearwood Road, Smethwick.

Group 2.—(South-Eastern Area) : December 3.

Judge : Alfred Pugh, Esq., of Pontycymmer, Glamorgan.

1st : F. W. Wright, 532 Moseley Road, Moseley.

2nd : Birmingham Co-operative Society, 1,102 Warwick Road, Acocks Green.

3rd : Birmingham Co-operative Society, 408 Coventry Road, Acocks Green.

Group 3.—(North-Eastern Area) : December 10.

Judge : J. B. Pitchford, Esq., of Newport (Mon.).

1st : Walter Barker, 98 Alum Rock Road, Saltley.

2nd : J. Rowberry, 23 Gravelly Hill, Erdington.

3rd : Birmingham Co-operative Society, 551 Green Lane, Small Heath.

Group 4.—(South-Western Area) : December 17.

Judge : G. H. Collinge, Esq., of Southport.

1st : J. A. Bates, 80 Bristol Street, Birmingham.

2nd : W. H. Haynes, 1 Oak Tree Lane, Selly Oak.

3rd : Ten Acres & Stirchley Co-operative Society, 1369 Pershore Road, Stirchley, and 725 Bristol Road, Northfield.

A circular letter was dispatched during December to every butcher selling National Mark beef in the London and Birmingham areas, asking them to make a special feature of

National Mark beef in their Christmas meat displays and offering to supply additional posters and other advertising material for this purpose.

H.R.H. the Duke of York visited the Ministry's National Mark Beef and Live Pig Exhibits at the Smithfield Club Fat Stock Show at the Royal Agricultural Hall, Islington, on December 8, and marked a side of beef on the Ministry's stand. A photograph of His Royal Highness, taken on the stand, is included in the accompanying illustration inset. After his visit to the Show, the Duke of York sent a letter to the Earl of Guilford, President of the Smithfield Club, in the following terms, in which the National Mark Beef Scheme is specially commended :—

145 Piccadilly,
W. 1.

December 8, 1930.

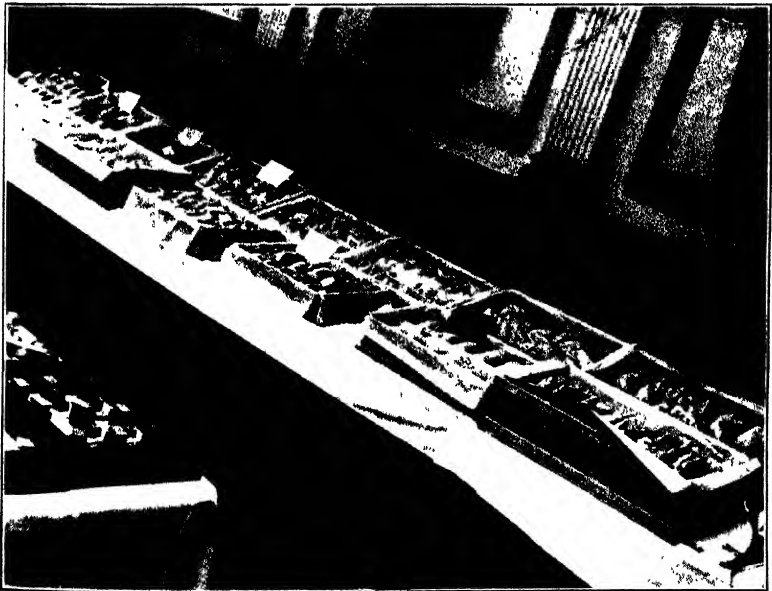
DEAR LORD GUILFORD,

It has been a great pleasure to me to visit Smithfield Show once again. The Smithfield Show is an outstanding event in the calendar, not only of the countryman but of the town dweller also, and it is no matter for surprise that it should be one of London's most popular autumn functions. But the Show is not only a magnificent spectacle ; it is an annual assertion and proof of the fact that the best British livestock is pre-eminent throughout the world, and I know how much this is due to the stimulating influence of the competitions organized by the Smithfield Club. I am glad to know that this year's Show is in every way worthy of the traditions established by its long line of predecessors, and I congratulate the Smithfield Club most heartily on the successful results of its enterprise and effort.

As a Vice-President of the Club, I take a special interest in the welfare of the cattle industry and in schemes for increasing its prosperity. A scheme which has for its object not only the general grading up of our livestock in this country, but also the improvement of meat marketing methods and the provision of a better service to the consuming public is therefore one that commends itself especially to me. For this reason, I was particularly interested in the display of National Mark Beef in the Gilbey Hall. I remember that my brother, the Prince of Wales, inaugurated the scheme at Islington Abattoir just a year ago, and I am very gratified to know that since then it has achieved a striking measure of success in London, where, I am told, practically the whole of the gradable supplies of Home-killed Beef on the Central Markets are, and have been for some time, graded and marked with the National Mark. It is clear that this progress could only have been achieved with the goodwill of all concerned, wholesaler, retailer, and consumer, and it is most encouraging to have such evidence of general support for a scheme which gives promise of help to our farmers and is at the same time a definite service to the public. I feel sure that the success of the scheme in London is a prelude to a similar result in Birmingham, a City which is not usually behind the Metropolis in adopting up-to-date methods, and I am glad to know that it is about to be extended to Leeds and Bradford.



H.R.H. The Duke of York inspecting the Ministry's display of National Mark Beef at the Smithfield Club Fat Stock Show on December 8, 1930. (See note on page 1016.)



Dressed Poultry Competition at the Gloucestershire Root, Fruit and Grain Show, 1930. General view of the display. (See note on page 1017.)

MARKETING NOTES.

To face page 1016.



Dressed Poultry Competition at the Gloucestershire Root, Fruit and Grain Show, 1930. The Winning Exhibit in the Special Class for a market pack of 12 chickens. (See note on page 1017.)



The New England "National Mark" quality label. The label is printed in yellow and dark blue, the name of the State and Grade on the scroll, also the number, being over-printed in red. (See note on p. 1024.)

There are, of course, many other features of the Smithfield Show which are worthy of attention, but I have referred in particular to the National Mark Scheme because of its national importance and because I feel that it is an essential complement to the great work which the Breed Societies have done and are still doing for the British livestock industry. Efficient production deserves efficient marketing.

Yours sincerely,

(Signed) ALBERT.

Displays of Home Produce.—By the courtesy of the Secretary of the Institute of Certificated Grocers, a valuable opportunity for a display of Home and Empire commodities has been provided on the occasion of the occupation by the Institute of new offices at 50 Doughty Street, London, W.C. 1. A room has been set apart for a period of six months, during which various commodities of interest to the grocery trade will be displayed in succession. The first display, which was staged for the opening ceremony on November 20, 1930, consisted of canned home-grown fruits and vegetables.

Arrangements have also been made for the use of a showcase in the entrance hall of the Hippodrome Theatre, Birmingham, for a period of three months, during which various National Mark commodities are being displayed.

Marketing Demonstrations.—Marketing demonstrations were staged during December at :—

Birmingham Fat Stock Show :

Nov. 29-Dec. 4. (National Mark Beef.)

Smithfield Show :

Agricultural Hall, London. Dec. 8-12. (National Mark Beef and Commercial Pigs.)

Dressed Poultry Competition at Gloucestershire Show.—At the Annual Exhibition of Produce arranged in connexion with the Gloucestershire Root, Fruit and Grain Show, held at Gloucester in November last under the auspices of the Gloucestershire Education Committee, a special class for a market pack of 12 chickens was included in the schedule of competitions. One of the Ministry's marketing officers acted as judge of this class and was much impressed by the quality and appearance of the best entries. Great credit is due to the Education Committee and to the County Poultry Instructor for their interest in the movement towards the better marketing of dressed poultry and for instituting a competition class that will, without doubt, soon become a regular feature at other shows.

It may be of interest to indicate the system of scoring adopted which was found to work well. The points were allotted as follows :—

	<i>Points</i>
(1) Quality—i.e., softness of breast meat	30
(2) Size with compactness	20
(3) Straightness of keel, fineness of bone and absence of surplus fat. . . .	20
(4) Fine texture and colour of skin	15
(5) General finish and marketable appearance ..	15
Total	100

Photographs of the display and of the winning pack, which secured 92 points, are, by the courtesy of the Education Committee, reproduced in the inset facing page 1017.

Pig Industry Council.—The standard of quality of the pig supplies of this country is somewhat low; this weakness is accentuated by a lack of knowledge of market requirements, commonly resulting in the consignment of pigs to markets for which they are least suited. Moreover, the practice of selling live pigs by auction in ungraded lots renders it difficult for the producer to measure the influence of quality upon price.

The Pig Industry Council has, therefore, under consideration an experiment with the object of testing the practicability of grading live pigs before sale by auction, and hopes shortly to be in a position to discuss details with the interests concerned.

The Agricultural Marketing Bill.—The three main agricultural organizations in Scotland have declared their approval of the principles of the Agricultural Marketing Bill. The Scottish National Farmers' Union, at a meeting on October 10 last, re-affirmed their former support of the principle of organized marketing, but suggested that it would be handicapped without the control of imports; a Committee has been appointed to consider the clauses of the Bill in detail and to make suggestions. Since that date, a joint deputation of this body and of the Scottish Agricultural Organization Society has waited on the Secretary of State for Scotland and assured him that their organizations supported the basic principles of the Bill, subject to amendments that are now the subject of discussion.

The Scottish Chamber of Agriculture has also approved the principle of the Bill, by a good majority, subject to satisfactory provision being made against the frustration of a scheme by imports.

Reorganization of the Milk Industry.—On Thursday, November 20, 1930, Lord De La Warr, Parliamentary

Secretary to the Ministry, received a deputation from the National Association of Creamery Proprietors to discuss proposals for reorganizing the milk industry. The discussion was of an informal character. The necessity for close co-operation between organized creameries and organized producers was emphasized by the deputation, but it was agreed that the comprehensive organization of milk producers under the Agricultural Marketing Bill was a necessary precedent to any satisfactory solution of the surplus problem, and the further development of the industry on sound lines.

Nova Scotia : Fruit Export Regulations.—The Canadian Fruit Export Regulations, made under Section 10 of the Fruit Act of 1927, came into force, in the Province of Nova Scotia, on September 20, 1930. The regulations provide that any fresh fruit (*i.e.*, apples, pears and plums) shall, before export, be subject to inspection and be certified to comply with all requirements of the Fruit Act and to be of the grade designated.

East Prussia : Cheese Control System.—Tilsit cheese, which corresponds in East Prussia to the Cheddar cheese of this country, is to become subject to a voluntary control system involving the use of an East Prussian trade-mark. The dairies that wish to make use of the mark will be subject to regulations drawn up by the Chamber of Agriculture for the province. These regulations will include a requirement that no cheese shall contain less than 45 per cent. of butter-fat in the moisture-free substance, and the stamping of defective cheese will not be permitted. The trade-mark will be placed both on the cheese itself and on the special packing to be adopted.

Grading and Marking of Beef in the U.S.A.—The beef grading and marking service in the United States, a note on which appeared in the September issue of this JOURNAL, is fully described in Leaflet No. 67, recently issued by the United States Department of Agriculture. The grading service was commenced experimentally at Chicago on May 2, 1927, and was eventually extended to eight other large centres. A permanent scheme was introduced on July 1, 1928, and a charge of \$2 an hour was made for the grader's time, with a minimum charge of \$1. Under favourable conditions, one man can grade from 60 to 75 carcasses an hour. On this basis, the cost of the service ranges from about 2½ to 3½ cents a carcass. The benefits of the service, as set out in the leaflet, are of interest :—

General.—Uninterrupted consumption of a product is largely dependent upon its conformity to certain recognized standards of quality.

Stockmen benefit primarily because the service ensures the sale of their finished product (beef) according to its standard of quality. If beef consumption is stimulated through more intelligent buying on the part of the consumer, it re-acts to the benefit of producers. Dealers have testified to increased sales since handling stamped beef.

Slaughterers and Packers.—Uniformity in quality of product, specially indicated by a label, increases confidence in purchases and tends to eliminate dissatisfaction and complaints. The service is, therefore, of material benefit to slaughterers and packers.

Wholesalers and Brokers.—The class and grade stamp on the beef is the Government's official statement of quality. When once a customer understands the significance of the grade terms, the time taken in placing orders is reduced to a minimum.

Retailers.—The retailer needs the confidence of the consuming public. This confidence is increased and the sale of products is helped if they bear identifiable grade stamps or marks signifying dependable quality. The grading service raises the standard of retail meat selling.

Hotels, Restaurants, etc.—Uniformity of the meat served in hotels and restaurants is of importance, as it often determines the reputation of a business of this nature. The proprietor can be reasonably certain of obtaining beef of the quality he wishes to serve by buying meat of the grade and class so stamped by the Government grader.

Housekeepers are assured of a degree of satisfaction commensurate with the grade of beef purchased. Beef possesses a wide range of quality which the average person is unable to distinguish. The Government's grade stamp is an assurance of quality and a means of identifying the various grades of beef.

The Advertising of Agricultural Produce in Germany.—The following abridged translation of an article that has recently appeared in a German agricultural journal* is an interesting survey of problems that are engaging attention not only in Germany but in this and many other countries. It is of particular interest and value to readers in this country in view of the broad similarity between agricultural marketing conditions in Germany and Great Britain.

If full use is to be made of publicity for agriculture it must comprise :—

- I. Publicity to assist the sales of agricultural products—
 - (1) directed towards the trade and the co-operatives ;
 - (2) directed towards the consumer.
- II. Publicity as a means of providing instruction and information within the agricultural industry—
 - (1) to improve the adjustment of production to market conditions ;
 - (2) to promote organization among producers.

Sales publicity is of outstanding importance. During the last decade, as a result of the increase in the national income and the

* *Blätter für Landwirtschaftliche Marktforschung* (Monatsschrift des Instituts für Landwirtschaftliche Marktforschung): Berlin, October, 1930.

development of industries catering both for ordinary and for luxury requirements, together with often extraordinarily successful advertising, there has been a redistribution of expenditure in the family budgets of large groups of the population. Expenditure on foodstuffs has declined relatively to other expenditure, although absolutely it has risen. It is only to be expected that a part of the increasing purchasing power should find an outlet in satisfying those new wants, additional to the mere need of food, that have arisen; but as the prosperity of the masses increases, agriculture must be especially concerned to see that an undue proportion of their increased purchasing power is not deflected from its own markets. If, however, publicity is desirable in times of prosperity, when a part of the increase of income goes in any case to raise the standard of food consumption, it is urgently needed in periods of depression, to ensure that as large a share as possible of the purchasing power of the public is retained for the markets for agricultural produce, and especially for high-class produce.

The great task of agricultural publicity is to produce in the psychological influences directed upon purchasers a balance that is fair to the agricultural industry. Abroad, this parity of industrial and agricultural publicity has to a great extent been achieved. More than 60 per cent. of the posters and bills in the New York subway advertise foodstuffs; and in other forms of advertising in the U.S.A., food is usually very prominent. In Germany, on the contrary, only a diminishing share of all publicity employed is devoted to foodstuffs.

The reason why food is so widely advertised in the U.S.A. is to be sought in the fact that in that country large concerns are engaged in the trade in foodstuffs. Firms like Swift, Armour, Libby, Borden or the General Food Corporation have made sales publicity a central feature of their marketing policy, no less than the soap and cigarette concerns. In Germany, such propaganda in favour of agricultural produce is difficult, partly because these giant organizations are only found in the trade in certain imported foodstuffs, such as margarine and bananas, and not in the trade in German agricultural produce. To carry out publicity campaigns, therefore, the scattered forces of farmers, of co-operatives and also of the trade must be gathered together.

Propaganda for farm produce costs money; and expensive methods of advertising costing hundreds of thousands of marks can only be undertaken by large organizations with ample supplies of capital. Moreover, except where special products are advertised, such publicity benefits not only the individual, but the whole farming community as well, so that the farmer is hardly prepared to spend considerable sums on advertising a product. *Thus, sales publicity, which is for the benefit of all, must be built up, not by individual effort, but like the farmers' market, upon a co-operative basis.* It remains none the less a matter for private enterprise. State assistance for agricultural publicity is required, but the chief costs must be borne by the parties interested—that is, by the farming community and agricultural societies, the trade and the co-operatives.

In particular, the agricultural co-operatives, which, as the trustees of the farmers, are interested in getting the best possible prices for their produce, are called upon to undertake this duty.

It is not only as regards finance that greater difficulties are encountered in advertising agricultural than industrial pro-

ducts. A further problem arises from the fact that sales publicity can only promise successful results if :—

- (1) an accurate impression of the commodity is conveyed ;
- (2) the quality of the commodity advertised strengthens the effect of the advertisement—that is, if the quality is good, consistent and reliable ; and
- (3) the product is found by the purchaser to be good value.

For a large proportion of German agricultural products, conditions (1) and (2) are still lacking. There are, it is true, certain standard products of individual producing concerns, whose managements pay special attention to giving a consistent and reliable quality, but these have little significance, taking the market as a whole.

How seriously this lack of the essential conditions of effective publicity affects the ordinary products on the market can best be appreciated if the attempts to advertise rye bread, fruit or vegetables are compared with the advertisements of such reliable manufactured products as Henkel's steel knives, Faber's pencils, Persil, and so on. It is clear that unless the conditions mentioned above as regards quality and uniformity have been fulfilled, the sudden outbreak of a collective publicity campaign advertising something described in general terms as "ryebread," "fruit" or "vegetables" will only cause bewilderment.

Advertising can only become effective when linked with a guarantee of quality. If, as is generally necessary, the function of giving guarantees is reserved to the State, and takes the form of establishing a standard and maintaining it by official inspection, then the solution is simple—the advertising of agricultural produce must be strictly limited to guaranteed produce. It will be necessary to persuade the purchaser by means of uniformly distinguishable advertising matter that he can always be sure of getting best quality goods, guaranteed by a system of inspection, if only he buys the standard advertised products.

It follows from the above that the first step in a publicity campaign for German agricultural produce must be to seek out all the products for which the conditions already indicated hold good. An intensive campaign is at present possible only for commodities that are already standardized, such as Hanover Mark Potatoes, Schleswig-Holstein Mark Butter, Mannheim Bottled Milk, or similar products.

The next step must be to find out what producing districts are worthy of special publicity when advertising a given product.

About the media of publicity there can be little dispute. If the campaign is to be effective, all modern devices must be employed. These include :—

- (1) the daily and trade Press ;
- (2) the wireless ;
- (3) films ; picture-strips in the schools and colleges ;
- (4) illuminated signs, posters, shop-signs and displays ;
- (5) the marking of goods with special brands ;
- (6) the pattern and make-up of the packing.

In short, advertisement is essential if the sales of German agricultural products are to be increased or even maintained. Large-scale advertising can only be undertaken by large-scale organizations. Effective advertising demands a standardized article of guaranteed quality.

A New England "National Mark" Plan.—For a number of years, the United States Department of Agriculture has given

much attention to the formulation of grades and standards for farm products. In some cases, notably cotton and wheat, the use of the official grades has been compulsory in inter-State commerce, but for the most part their use is still voluntary. In this work, the efforts of the Federal Government have been supplemented by those of the State legislatures, which have provided for the establishment of State grades—usually identical with the U.S. grades—for the chief products raised in their areas, and have made appropriations for the administrative and inspection services required.

Recently, a further step has been taken in marketing improvement by the introduction of marking or labelling schemes—resembling, in some respects, the National Mark schemes in this country—which seek to bring the consumer within the ambit of a standard grading system. It may, therefore, be of interest to give a brief outline of one of these schemes—the New England Farm Marketing Programme.

This scheme, like the National Mark schemes of this country, applies to an area which obtains the bulk of its food supplies from external sources. New England, however, is even more highly industrialized than old England, less than 10 per cent. of its population living on farms. This is no doubt largely due to the superior productivity of other areas in the United States and elsewhere; but this is not the case with all the farm products raised in New England.

For the production of eggs, vegetables and certain fruits, New England has soil and climatic conditions as favourable as anywhere and has a great additional advantage in its close proximity to markets; yet its share of the home market is annually declining in the face of the competition of supplies from distant areas, in many cases three thousand miles away.

In 1926, the New England Council, an organization formed for promoting the common interests of the six New England States, set its Agricultural Committee to work on the problem. The conclusion finally arrived at was that “the absence of a concerted marketing programme for New England producers has made effective opposition to such competition most difficult, and our hesitancy to adopt standard packs, uniform grades and proper identification of graded produce has retarded the sale of local produce to many local buyers demanding large quantities and uniform quality.” A marketing conference was accordingly held in Boston at the end of the year which, “after due consideration of the problem, acknowledged the need for united efforts by all the New England States in a

programme that would outline grades for all the leading native-grown products and would make possible the standardization of packs and the identification and inspection of the strictly local-grown products graded to New England standards." The conference further suggested that each State should secure legislative authority to enable its Commissioner of Agriculture to promulgate tentative grades for a few of the more important products. Commodity groups were appointed to work out details.

At a second conference, held a year later, the design of the mark was established and grades were approved for eggs, apples, asparagus, celery, strawberries, bunch beets, carrots, turnips and globe radishes. These grades were recommended to the Commissioners of Agriculture for promulgation as State grades, all the New England States, with the exception of New Hampshire (which, however, ultimately came into line) having successfully put through the legislation enabling them to participate in a uniform New England marketing programme. As the demand arose, other commodities received attention, an effort being made to keep the State grades as uniform as possible.

The Commissioner of Agriculture in each State is authorized to adopt a label identifying the products graded and packed to official standards. The New England quality label (see illustration in inset facing page 1017), supplies of which are obtainable only through the Commissioners of Agriculture, is used for this purpose in all the States. A small charge is made for the labels.

In general, no preliminary qualifications are required of applicants for permission to use the labels. In New Hampshire, however, some form of inquiry is apparently made to ascertain that the applicant has a proper understanding of the programme and also the equipment for raising the product of the quality designated. In Connecticut, also, the regulations regarding the official "New-laid Fancy" egg grade require a rather rigid inspection of the poultry plant in so far as health and sanitation are concerned. Although permission to use the mark is not specifically limited to actual producers, the majority of the registered users are, in fact, either producers or producers' co-operative organizations. There is no qualification as to minimum output or turnover.

The need for protecting the reputation of the label is recognized. Each State Department of Agriculture maintains an inspection service of trained men whose duties are to

examine the graded and labelled products in the ordinary channels of trade and to satisfy themselves that the products thus identified meet the requirements of the grade. A substantial penalty provides against misuse, although the power to withdraw the privilege of using the labels is regarded as a sufficient safeguard in most cases. Inspection work is at present strictly on a State basis, but, with the rapid progress of the scheme, the question of providing an inter-State service has forced itself to the front.

No attempt has so far been made to make the scheme self-supporting. It is felt that while the scheme is in its infancy, most of the work can be handled by the existing staffs of the Departments of Agriculture. When the programme becomes firmly established, it is anticipated that all or a part of the costs of the service will be transferred to the users.

Some idea of the extent to which the programme has been adopted may be gathered from the following Table showing the number of users and the labels sold during the two-and-a-half years of its operation :—

NEW ENGLAND QUALITY LABELS ISSUED UP TO OCTOBER 1, 1930.

<i>Type of Label</i>	<i>No. of Users</i>				<i>Labels sold</i>
Apples	27	..	..	..	156,150
Eggs	422	..	..	..	2,924,725
Asparagus	39	..	..	..	157,000
Celery	3	..	..	..	165,000
Potatoes	26	..	..	..	63,950
Turkey	131	..	..	..	33,746
Baby chicks	47	..	..	..	10,700
Strawberries	65	..	..	..	13,250
Tomatoes	23	..	..	..	58,000
Jelly	1	..	..	..	1,000
Maple sugar	208	..	..	..	239,960
Honey	4	..	..	..	43,000
Butter	2	..	..	..	126,000
Lettuce	9	..	..	..	33,000
Total	1,007	..	..	..	4,025,481

In addition, 1,788,243 standard containers and markers were sold during the same period to 443 users.

It is difficult to say what price advantage is actually received by the producer whose supplies are marketed under the New England label compared with other producers, but a few figures are available. Fairly complete data on eggs sold in Rhode Island show that the near-by graded eggs, sold under the label, returned the producer approximately 5 cents a dozen more when sold wholesale, and 10 cents a dozen more when sold retail. In Maine, potatoes marketed under the

label commanded a premium of 10 cents per 100 lb. and apples of 50 cents a bushel. In Massachusetts, a co-operative organization calculated that the gains attributable to the use of the label on asparagus amounted to \$206.98 per member on a season's pack. Apart from actual price premiums, all States reported that the use of the label assisted greatly in moving the produce on a glutted market and in ensuring a steady demand at all times.

* * * * *

AGRICULTURAL RETURNS OF ENGLAND AND WALES, 1930

Produce of Crops.—Apart from hay, the harvest of 1930 has proved unsatisfactory, particularly in comparison with the generally good results obtained last year. The corn harvest was adversely affected by the unfavourable weather conditions which prevailed during the greater part of August and September and, with the exception of beans, yields per acre have been materially below those of 1929. The yields per acre of wheat and barley were also less than the ten years' average. The lower yields obtained from areas which, for most corn crops, had been reduced, resulted in a total production which was substantially less than that of 1929. Potatoes were planted on a much smaller area than in the previous year, while the yield per acre, although slightly above average, was inferior to that of 1929. As a result the total production shows a marked reduction. The yields per acre of turnips and swedes and also of mangolds, although below the ten years' average, were much the same as in 1929, but the total production was somewhat lower owing to a reduction in the acreage.

Both seeds and meadow hay, however, gave yields per acre which showed a decided improvement over 1929, and were above the average. In addition, an increased area was cropped.

Corn Crops.—**WHEAT.**—The poor yield per acre more than counteracted the slight increase in the area under wheat, and the total production this year, which is estimated at 21,404,000 cwt., shows a reduction on the year of about 4 million cwt., or nearly 16 per cent. The yield per acre, estimated at 15.9 cwt., is 3.2 cwt. less than in 1929 and 1.8 cwt. below the ten years' average. Poor yields were general throughout the country, only seven counties obtaining over average results, and these were in areas where wheat growing is of minor importance. In the North-Eastern and Eastern divisions yields were as much as 3.2 and 2.7 cwt. respectively below the average.

PRELIMINARY STATEMENT SHOWING THE ESTIMATED TOTAL PRODUCE AND YIELD PER ACRE OF THE CORN, HAY AND ROOT CROPS IN ENGLAND AND WALES IN 1930, WITH COMPARISONS FOR 1929, AND THE AVERAGE YIELD PER ACRE OF THE TEN YEARS 1920-29.

Crops	Estimated Total Produce		Acreage		Estimated Yield per Acre		
	1930	1929	1930	1929	1930	1929	Average of the ten years, 1920-29
	Thou- sands of cwt.	Thou- sands of cwt.	Acres	Acres	Cwt.	Cwt.	Cwt.
Wheat ..	21,404	25,425	1,346,090	1,330,122	15.9	19.1	17.7
Barley ..	14,735	19,951	1,020,371	1,120,247	14.4	17.8	15.6
Oats ..	26,818	30,640	1,777,790	1,853,790	15.1	16.5	14.5
Mixed Corn	2,007	2,323	130,111	138,592	15.4	16.8	14.8
Beans ..	2,779	2,201	161,342	144,435	17.2	15.2	16.3
Peas ..	1,157	1,281	78,237	78,635	14.8	16.3	14.2
	Thou- sands of tons	Thou- sands of tons					
Seeds Hay*	2,321	1,746	1,595,462	1,523,692	29.1	22.9	27.7
Meadow Hay† ..	5,587	3,595	5,051,711	4,695,916	22.1	15.3	20.2
Potatoes ..	2,741	3,588	424,408	518,813	6.5	6.9	6.2
Turnips & Swedes	7,928	8,304	669,977	697,878	11.8	11.9	12.5
Mangolds	5,441	5,687	288,004	298,690	18.9	19.0	19.1

* Hay from Clover, Sainfoin, and Grasses under rotation.

† Hay from Permanent Grass.

BARLEY.—Both the area and the estimated yield per acre of barley were well below the figures recorded in 1929, and the total production fell by over 5 million cwt. to 14,735,000 cwt., a decline of 26 per cent. Over the whole country the average yield was 14.4 cwt. per acre, a decrease of 3.4 cwt. compared with 1929 and 1.2 cwt. below average. Low yields were, however, by no means general, nearly one-half of the individual counties exceeding the average, but in the North-Eastern and Eastern divisions yields were below the average by 2.1 and 1.7 cwt., respectively.

OATS.—The yield per acre of oats, estimated at 15.1 cwt., showed a smaller decrease on the year than that of either wheat or barley, while, moreover, it was rather above the ten

years' average. The area harvested was somewhat less than in 1929, and the estimated total production at 26,818,000 cwt. was smaller by 12·5 per cent. On the whole, the most satisfactory yields per acre relatively were obtained in Wales, each Welsh county returning an over average yield. In the majority of the English counties also yields were rather above the average, but the North-Eastern division provided an important exception with under average yields in each county.

MIXED CORN.—The total production in mixed corn this year is estimated at 2,007,000 cwt., against 2,323,000 cwt. in the previous year, the reduction being caused by a combination of a smaller area and lower yields. The yield per acre at 15·4 cwt. was below that of 1929 by 1·4 cwt., although rather above the average.

BEANS.—The estimated yield per acre of beans harvested as corn was 17·2 cwt., a marked improvement compared with 1929, and about 1 cwt. per acre over the ten years' average. In addition, a larger area was harvested, and the total production at 2,779,000 cwt. was 26 per cent. more than in 1929.

PEAS.—The area of peas harvested as corn was much the same as in the previous year, but the estimated yield per acre fell by 1·5 cwt. to 14·8 cwt., which, nevertheless, was somewhat over the average. The total production at 1,157,000 cwt. showed a decline of 10 per cent.

Hay.—In the earlier part of the season conditions for the hay crop were unusually favourable, and yields per acre showed a marked improvement over those of 1929, and were above the average. Unfavourable weather conditions developed, however, towards the close of the harvest, and as a result a proportion of the crop in a number of districts was spoilt. For the most part the areas affected were in Wales and in the Northern part of England.

SEEDS HAY.—The crop of seeds hay is estimated to have yielded 29·1 cwt. per acre, an increase of over 6 cwt. compared with 1929, and 1·4 cwt. over the ten years' average. The crop was taken from a somewhat larger area, and the estimated total production rose by 575,000 tons to 2,321,000 tons. Over two-thirds of the counties secured over average yields, the remaining counties being situated mostly in Wales and the North of England.

MEADOW HAY.—The total production of meadow hay, estimated at 5,587,000 tons, exceeded that of 1929 by nearly 2 million tons, an increase in the area cropped being accompanied by much heavier yields. The yield per acre was

estimated at 22.1 cwt., or practically 7 cwt. more than in the previous year, and about 2 cwt. over the ten years' average. As is the case in seeds hay yields in several counties in Wales and the North of England were below average, but the majority of counties obtained over average results.

Potatoes.—With a reduced area and a smaller yield per acre the estimated production of potatoes at 2,741,000 tons is below that of 1929 by 847,000 tons, or 24 per cent. The yield per acre is estimated at 6.5 tons per acre against 6.9 tons in 1929, and the ten years' average of 6.2 tons. In most counties of the North-Western division, and also in the Isle of Ely and the Holland division of Lincoln, yields per acre were very slightly below average, but in the remaining parts of the country above average yields were general.

Roots.—TURNIPS AND SWEDES.—The yield of turnips and swedes, estimated at 11.8 tons per acre, was almost equal to last year's yield, but about two-thirds of a ton below average. The area was, however, reduced and the estimated total production declined from 8,304,000 tons to 7,928,000 tons. On the whole, the poorest results were obtained in the Northern division, where the yield was 2½ tons below the average, deviations from the average being much less pronounced in the other divisions.

MANGOLDS.—The total production of mangolds is estimated at 5,441,000 tons, against 5,687,000 tons in 1929. The reduction was due mainly to a smaller acreage, the estimated yield per acre being nearly equal to that of 1929, although slightly below average. In North Wales, and in five of the English divisions, yields were above the average, but most counties in the Northern, North-Western and North-Eastern divisions returned under average yields.

SUGAR BEET.—The area under sugar beet has shown a further substantial increase, while, as far as can be estimated at present, the yield of washed and topped roots is likely to amount to about 9 tons per acre, against 8.7 tons last year. On this basis a crop of over 3,000,000 tons may be anticipated. Reports indicate that the sugar content is lower than last year.

JANUARY ON THE FARM

WILLIAM LAWSON, M.B.E., N.D.A., N.D.D.,

Director of Agriculture for West Sussex.

Arable Land.—Work on arable land is restricted. Stubbles not already moved should be ploughed, provided the weather is not too wet. Much harm can be done to heavy soils by working them under unsuitable conditions. Heavy land ploughed under wet conditions dries “steely” and hard unless mellowed by frost. The chances of severe frost after this month are reduced, although the prolonged frost in the spring of 1929 did not set in until the second week in February. Experience in that year clearly proved the value of frost in producing a good tilth, and no difficulty was experienced in getting a good seed bed for both corn and root crops. The spring of 1930 was almost the exact opposite; wherever land had been moved under wet conditions the tilth at seeding time was most unkind, and much extra work had to be done to bring the soil into a reasonable condition for sowing.

Soils vary to an extraordinary extent in workability. Light sandy soils may appear to work safely under all ordinary conditions, but many practical men assert that ploughing and working light soils during very wet weather conditions encourage finger-and-toe disease in turnips and swedes. Such soils are naturally more liable to grow diseased plants when there is deficiency of lime on such land, and when the farming practice is to grow swedes and turnips frequently in the cropping rotation.

The heavy sticky clays are the opposite extreme. The farmer must know his soil and the conditions under which it may be worked, or rather the conditions under which it must not be worked, if he is to avoid causing damage. Heavy soils that have been damaged by working under unsuitable conditions are difficult to handle, and a restoration of good physical condition may be accomplished only by numerous cultivations under good conditions, by frost or by summer fallow.

Frost to the extent required may not occur when the land is prepared for it, and even summer fallow conditions cannot be relied upon. There are large areas of heavy land that have been allowed to go out of cultivation and have tumbled down to most unsatisfactory grass in this spoiled physical condition. Heavy land is expensive to work at the best of times, owing to the limited number of days on which it is fit, but when spoiled by bad working the expense and labour are increased and the returns diminished.

Farmyard manure and lime or chalk have a good effect on texture and improve the friability of the soil, reduce the number of cultivations necessary to get a good tilth, and increase the number of days on which the land may be worked.

Under favourable weather conditions in the south, oats may be drilled this month, but it is not usual for much sowing to be done till February, and March is still more common. Where early sowing can be done any of the usual spring varieties can be used, but the variety Marvellous appears to be specially suited for really early sowing. For a number of years this variety of white oat was sown in autumn, and in mild winters was a complete success in the south, but it failed over very large areas in the winters of 1927-28 and 1928-29. Early sowing during January or February is specially suitable for this variety, and its strong straw reduces the chances of a laid crop at harvest.

Carting of farmyard manure is one of the main jobs during frosty weather. It is very desirable and a real help to get the manure to the field in which it is to be used, and to stack it in a large compact mix until it is possible to distribute it on the land and get it ploughed in. The practice of putting the manure in small heaps on the ground ready for spreading when the frost goes away causes depreciation of the manure. Loss will also occur in the mix, but the effect of farmyard manure is most pronounced when it is carted from the mix, spread over the land and ploughed in as quickly as possible.

Odd Jobs.—The slackness of work on the land makes available men and horses for odd jobs. The farm road must now be more than a mere cart track. A motor car requires a reasonable road, and whether the farmer owns a car or not, local tradesmen and milk lorries will avoid the farms and cottages where there is no easy access. Roads require more maintenance than formerly, and the wear and tear is heavier. In making or maintaining a road the most important thing is to get the surface water off as quickly as possible, as no amount of material will make a good road and stand the traffic if water is allowed to lie on it or to wash down the tracks.

Gateways into fields can now receive attention ; the wear of stock or traffic creates low places at the gateways, and these collect water and rapidly deteriorate. It ought not to be necessary to say that the gateways should be kept well built up and dry, but the condition of very many gateways justifies calling attention to the matter.

Grass Land.—There is still time to put mineral manures on land that has been well fed down or severely harrowed. Fields that are expected to produce early grass should now be free of stock, although the application of nitrogeous manures may be delayed till later. Light soils may be rolled, but this work should not be done on heavy land under wet conditions. Many farmers prefer to roll when they can see that the roller is having some effect, but on heavy land injury may be done.

Sheep.—Sheep require special care at this time. It is an old saying that as the day lengthens the cold strengthens. Wet and cold conditions and the short day are a severe handicap to the sheep, and they require more food than at any other season. Some dry food is of real value, and sheep on roots should have hay or grain and cake. Grass sheep vary in their requirements according to conditions, but where supplementary foods are to be given the animals should not be allowed to get down in condition before one begins to feed them. Once feeding is commenced it should be continued until the grass makes good growth. Fattening sheep on roots benefit by a supplement of hay, and if they are to be finished early cake and corn will be necessary. Early breeding sheep will soon be lambing and demand the greatest skill of the farmer and shepherd. Feeding must be suitable and liberal. This is very special work, and whether the aim is ram breeding or the early fat lamb trade special prices are required to reward the skill and expense involved. The milking capacity of the ewe is an important feature in the early life of the lamb. Observations and tests of the milking capacity of the ewe are difficult, except by judging the lamb, and this is masked by the inherent capacity of the lamb to make use of the milk. The dairy cow has been accurately observed and studied, and a few of the main factors no doubt apply to sheep.

The first feature of importance is that the milking capacity is inherited. Breeds of the mountain type of sheep have a reputation for being better milkers than lowland breeds, and this no doubt is a result of selection under conditions where supplementary feeding of the lamb is not practised. The effect of a poor milking mother would be to diminish the chances of its offspring being good enough to be saved for the flock.

Feeding and management of the cow can account for big differences in yield. Balanced and controlled rations are the

every-day practice in well-managed herds, and, while it is not possible to measure accurately the day-to-day yield of the ewes or to feed them individually, a few general methods applicable to the dairy herd may have some application to the nursing ewes. Feeding of concentrates before roots and roots before hay has a natural tendency to prevent the animal overloading its stomach, and promotes better digestion. Constant access to clean water is also important, as the greater the yield of milk the greater is the need for water. With cows, over four gallons of water are taken up for each gallon of milk produced.

Frozen roots and ice-cold water are distinctly harmful to milk production, and with ewes this may be a real difficulty at this season of the year. Much has been said about the effect of roots on the milk yield of cows, and without entering into controversy it may be assumed that roots will still produce milk in excess of the requirements of the offspring, and with sheep some laxative green food is valuable and necessary. The quantity should not be excessive; where it is restricted a supply of water is of great importance.

Cattle.—Cattle wintered outside will require more food now if they are to maintain their condition. Grass is rather inferior, and if frosts are prevalent some hay or good straw will be necessary. A few roots will be appreciated. Cake or grain supplements are of doubtful value when given in addition to hay or good straw and roots. Outwintered cattle that have had no concentrated food in winter are in a position to make the best possible use of the early spring grass, and the cost of concentrated foods may not be recovered.

Cattle in yards or tied up cannot safely be turned out till the weather is favourable, and they do not get the full advantage of early grass. In such circumstances concentrated foods are justified, and should be sufficient in amount to produce a difference in the appearance of the animals, particularly if they are being prepared for sale. Roots and straw or hay will bring the older cattle through the winter cheaply, and 2 lb. of concentrates per head per day may make so little difference as to be unprofitable, whereas 4 lb. per head per day might produce that bloom and thriving condition that is attractive in the sale ring. Such statements may seem contradictory, but very moderate feeding of concentrates may often be uneconomical where more liberal feeding would give good returns.

NOTES ON MANURES

H. V. GARNER, M.A., B.Sc.,

Rothamsted Experimental Station.

Manures for Clovers.—Both from the point of view of the maintenance of humus and also the improvement in tilth due to the crumbling effect of its mass of fibrous roots, the seeds ley is a great asset in arable farming. If at the same time the leguminous plants of the seeds mixture can be stimulated into vigorous growth, a very real addition to the soil nitrogen supply is secured. This extra nitrogen, becoming available for the crops which follow, represents a definite gain in fertility. Cases are by no means rare in which cereal crops following ploughed-up leys which were very rich in clover have shown the signs associated with too much nitrogen. There is one principle in manurial practice which really holds over a very wide set of conditions: a good supply of mineral fertilizers, phosphates, potash and lime, greatly assist the leguminous plants in their competition with the grasses. Numbers of botanical analyses of the herbage from pasture of all kinds, both permanent and temporary, and also experience with forage mixtures of cereals and leguminous crops, have demonstrated this. As an illustration it may be in place to quote the results from the Park Grass plots at Rothamsted, where various mineral fertilizers have been used on a series of plots for many years.

BOTANICAL COMPOSITION AND YIELD OF FIRST CROP

Average 1921-1924

	Grasses per cent.	Clovers per cent.	Weeds per cent.	Yield cwt. per acre
No manure ..	62	7	31	14
Lime	58	10	32	14
Minerals* ..	64	18	18	27
Minerals with lime	54	36	10	34

* Superphosphate and sulphates of potash, soda and magnesia.

While lime alone has not produced much effect either in the quantity of the herbage or the amount of leguminous plants, the use of minerals has more than doubled the proportion of clovers and also doubled the total yield. At this stage the further addition of lime now doubles the amount of legumes and also appreciably increases the yield. It is interesting to examine the effect of the individual constituents of the mineral mixture on the composition of the hay. This can be seen from the results of the botanical analyses over a series of years, 1903-1919.

PERCENTAGE OF LEGUMINOUS HERBAGE*

	Lowest	Highest
Phosphate, potash, soda, magnesia	8.7	33.2
Phosphate, soda, magnesia	2.7	20.3
Phosphate	2.6	17.6

It is clear that under the continuous hay-cutting conditions of the Rothamsted plots, which are highly unfavourable to a persistent growth of clover, the use of phosphate alone is insufficient to maintain a high proportion of leguminous herbage in the turf. This is not greatly improved by the addition of sodium and magnesium salts (which occur in ordinary practice as the impurities in low-grade potash salts). On the other hand, the further addition of potash produces a marked effect in increasing the clovers. In normal circumstances, where grazing is practised periodically during the life of the turf, even more pronounced responses of leguminous plants to these manures may be expected; for not only is the shading-out of clovers much less severe, but the bulk of the potash removed from the land is returned as manure. Moreover, if the soil is naturally rich in one or more of these constituents artificial addition will be unnecessary. On many soils this is true of lime; on good clay soils where dung is occasionally given potash should not be required, and a source of phosphate such as basic slag should give excellent results with the clovers. An increasing number of cases are coming to the notice of farmers in which a potash dressing is necessary in addition to the phosphate in order to maintain the quality of the turf or to secure a good sole of clover in a ley. Potash salts of the 20 or 30 per cent. grade are quite suitable for this purpose, and may be mixed with basic slag or with rock phosphate when the latter has proved itself to be effective. A usual scale of dressing for the leys or for permanent grass would be about 4-6 cwt. of 30 per cent. basic slag or its equivalent, with 2 cwt. of 30 per cent. potash salts or its equivalent of the 14 or 20 per cent. grade, where potash is known to be helpful. The need for lime is best decided on the basis of a sample analytical test carried out in conjunction with the County Agricultural Organizer.

Dressings such as the above may be supplied in winter or very early in spring at a time when the grass is short.

Quality in Barley.—In a recent paper† dealing with his work at Rothamsted on the nitrogen content of barley and its influence on quality, Dr. L. R. Bishop has discussed the effects

* W. E. Brenchley, *Manuring of Grassland for Hay*, 1924.

† The Nitrogen Content and Quality of Barley: *J. Inst. Brew.*, XXXVI, 1930, pp. 352-569.

of manuring, soil and season on the quality of barley in a way which serves to explain certain views which are widely held by growers. On the other hand, he has pointed out various erroneous ideas which have gained acceptance. It may be of interest to give some of his main conclusions from the parts of the paper dealing with the more practical side of the question.

Starting from the view that the nitrogen content of the grain is a very good index of market value, i.e., within certain limits the lower the nitrogen the better the barley, it is important for growers to realize the factors that make for a low nitrogen percentage in the grain, or the reverse. It should be borne in mind that if two barleys take up equal amounts of nitrogen from the soil and one makes more carbohydrate (starch) in the grain than the other the first will have a lower percentage of nitrogen in the grain than the second, although the actual amount of nitrogen may be equal. Hence production of carbohydrate tends to lower the percentage of nitrogen in the grain and has a favourable influence both on yield and quality.

Under ordinary conditions of farming it has been shown repeatedly that of the three common fertilizer constituents, nitrogen has by far the most potent effect in increasing the yield of barley. The period in the life of the plant at which this nitrogen is supplied is, however, of very great influence on the quality of the resulting grain. What is wanted is a good supply of nitrogen in an available form at the early stages, to stimulate vegetative growth and form an adequate leaf-surface which in turn can build up abundant carbohydrate to be passed on to the seed. The barley soil should be rich in nitrate in the spring, rather than later on in the season. Nitrogenous manures are best given in the spring in the seed bed, or at any rate in very early top dressings. In this way, given favourable weather conditions, nitrogen increases the yield without raising the percentage of nitrogen in the grain. Therefore a good yield and high quality are not, as is sometimes supposed, incompatible. On the other hand, nitrogen applied as later top dressings, or coming into action late in the season, tends to raise the percentage of nitrogen in the grain by failing to produce a counterbalancing yield increase.

This happens in very rich organic soils, or soils plentifully supplied with farmyard manure or the residues of heavy sheeping. The last two cases are well recognized by growers as productive of low quality barley.

This action of a late supply of nitrogen also explains the association of poor quality with an abundance of small immature

grains, these being the result of the survival of late tillers that would never have made grain at all had it not been for the presence of abundant nitrogen in summer. Also, the effect of wide spacing in reducing the quality can be assigned to the same cause, as the roots have greater soil volume to search for nitrogen and therefore continue to take it up later in the season.

The other side to the question is the production of carbohydrate. High yielding varieties tend to have a lower nitrogen content than those that produce less ; similarly early varieties with their shorter period of growth tend to be higher in nitrogen than the later sorts with their longer assimilative phase. Late sowing, by cutting down the period of active assimilation, has the effect of raising the nitrogen percentage, as also does any serious check in growth due to drought at a time when the rapid building up of starch should be taking place.

The weather is of course a vital factor in the growth of any crop. In the above paper the conclusions are summarized from several statistical studies concerning the effect of season on the growth of barley, and explanations are suggested for the observed effects. A dry March and April benefit yield, probably as the result of early sowing in a dry seed bed and also of the conservation of nitrate. A low temperature in May is also beneficial. In this case the prolongation of the assimilative phase helps the yield ; conversely, if hot weather sets in in May the energies of the plant are diverted from assimilation to translocation with consequent reduction of yield. Rain in June and July is an advantage in the drier parts of England ; here the effect is no doubt associated with the postponement of the ripening process and prolongation of the passage of starch to the grain. The converse condition to this is premature ripening which admittedly cuts down the yield.

Early Spring Oats.—Those who sow spring oats very early in the year to escape the danger of frit fly should consider whether the young plants will find sufficient phosphate to help them to get established early. Unless a generous application has been made to the previous crop the application of 2 cwt. of superphosphate or basic slag would be desirable. Only on light soils would potash be required, when 1 cwt. of 30 per cent. potash salts might be used as well as the phosphate. In this case, if part of the superphosphate were replaced by steamed bone flour a drier mixture would result. If nitrogen is required—and this will usually be the case—at this time of the year the choice might be restricted to a light dressing of either sulphate of ammonia or cyanamide, as nitric nitrogen would quite probably be washed out before the crop was in full growth. The

remainder of the nitrogen could be reserved for a top dressing either as nitro-chalk or nitrate of soda later in the spring. Not only will the phosphate help to give the plant a good start, but a moderate dose of nitrogen in the seed bed will help in the same direction.

PRICES OF ARTIFICIAL MANURES

Description	Average prices per ton during week ended December 12				
	Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) ..	9 15d	9 15d	9 15d	9 15d	12 7
Nitro-chalk (N. 15½%) ..	9 7d	9 7d	9 7d	9 7d	12 1
Sulphate of ammonia :—					
Neutral (N. 20·6%) ..	9 5d	9 5d	9 5d	9 5d	9 0
Calcium cyanamide (N. 20·6%) ..	8 11e	8 11e	8 11e	8 11e	8 3
Kainit (Pot. 14%) ..	3 6	2 10	2 18	3 3	4 6
Potash salts (Pot. 30%) ..	5 3	4 8	4 18	4 17	3 3
„ (Pot. 20%) ..	3 15	3 0	3 7	3 10	3 6
Muriate of potash (Pot. 50%) ..	9 12	9 0	8 18	9 5	3 8
Sulphate, „ (Pot. 48%) ..	11 13	11 2	10 19	11 5	4 8
Basic Slag (P.A. 15½%)|| ..	2 13c	2 3c	..	2 9c	3 1
„ (P.A. 14%)|| ..	2 7c	1 16c	1 16c	2 3c	3 2
„ (P.A. 11%)|| ..	..	1 9c	1 9c	..	..
Ground rock phosphate (P.A. 26-27½%)|| ..	2 2a	2 10a	2 5a	2 7a	1 9
Superphosphate (S.P.A. 16%) ..	3 11	..	3 9	3 6	4 2
„ (S.P.A. 13½%) ..	3 5	2 18	3 3	3 0	4 4
Bone meal (N. 3½%, P.A. 20½%) ..	8 15	8 10	8 7	6 12	..
Steamed bone flour (N. ½%, P.A. 27½-29½%) ..	5 17b	5 15f	5 15	4 7	..
Burnt Lump Lime ..	1 5l	1 2m	1 9	1 17h	..
Ground Lime ..	1 12l	1 8m	..	1 12h	..
„ Limestone ..	1 3l	1 6g	1 8k	..	..
„ Chalk ..	..	1 6g	..	1 11h	..
Slaked Lime ..	..	..	2 9	2 17h	..

Abbreviations: N.—Nitrogen; P.A.—Phosphoric Acid; S.P.A.—Soluble Phosphoric Acid; Pot.—Potash.

* Prices are for not less than 6-ton lots, for delivery during the month, at purchaser's nearest railway station, unless otherwise stated. Unit values are calculated on carriage paid price.

† Prices are for not less than 2-ton lots, net cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. price.

|| Fineness 80%, through standard sieve. a Prices for 6-ton lots f.o.r. at makers' works.

b Delivered (within a limited area) at purchaser's nearest railway station.

c Prices for 6-ton lots; at Bristol, f.o.r. Bridgwater; at Hull and Liverpool, f.o.r. neighbouring works, and at London f.o.r. depots in London district.

d For lots of 4 tons and under 6 tons the price is 1s. per ton extra and for lots of 2 tons and under 4 tons 5s. per ton extra.

e Delivered in 4-ton lots at purchaser's nearest railway station.

f Delivered Yorkshire stations.

g F.o.r. Knottingley. Ground limestone 100% through standard sieve.

h Carriage paid 6-ton lots London, bags included.

i In bags, f.o.r. Liverpool. Fineness 45% through standard sieve.

j Carriage paid 6-ton lots Bristol.

k Carriage paid 6-ton lots Knottingley.

NOTES ON FEEDING STUFFS

H. G. SANDERS, M.A., Ph.D.,
School of Agriculture, Cambridge.

Effects of Protein and Calcium Deficiency in Pig Rations.—

Probably the chief factor in determining success in pig breeding (as, indeed, in the breeding of all farm stock) is prolificacy. Improvement of type is obviously good, but progress in that can be judged by the eye, and is constantly stimulated by our show system. Fertility, however, is more a matter of book-keeping, and it is doubtful if it receives sufficient attention. That this characteristic of fertility is heritable has been established by a large amount of observation and experiment, and the system of pig-recording, only lately introduced into this country and described in this JOURNAL for November, 1929, shows how important is the part it plays, and how it promises to assist very materially in improving fertility in the near future.

The whole subject of fertility in animals is an interesting one, but it presents difficulties, because, though the essential processes are similar, the agricultural problem of improvement differs from species to species. In general the number of young produced depends primarily on the number of eggs produced by the female, and it would be supposed that in an animal like the sow, which has large litters compared with others, this would be the determining factor. Curiously enough inquiry has shown that this is not the case. Normally the sow produces plenty of eggs, and these are nearly all fertilized and start to develop, but often a considerable proportion of them will go wrong during pregnancy. Some degenerate very early and usually pass unnoticed in the afterbirth at farrowing, others develop to a fair size and then go back, whilst the "dilling" of the litter may be one that has just, but only just, lasted over the period of gestation, and starts life with a big handicap. The number of "wrong uns" (known scientifically as atrophic foetuses) varies very much from litter to litter, and it has been shown that fertility is very largely dependent on it. It therefore follows that the problem of raising the litter size hangs on the avoidance of atrophic foetuses, and that the first thing for the scientist to do is to find out what causes this condition. Absence of a vitamin (E) has been shown to lead to degenerate foetuses in rats, but in that case all the foetuses die, and not merely a proportion of them. Further, in practice Vitamin E deficiency can hardly ever occur, so that it appears that the solution can scarcely be found along that line.

It is being established beyond all doubt that degeneration of foetuses is a heritable characteristic, and with pigs it appears that heredity plays its part in fertility by this means. Nevertheless, on the face of it external factors might very well affect the proportion that degenerate, so that research on the physiological side is obviously needed. The results of one exhaustive inquiry on these lines have just been published by Mr. Davidson, now of the Rowatt Research Institute, though the work was done at Cambridge from 1921 to 1928.

Essentially the design of the experiment was simple, though, as with all records of breeding experiments carried on for several generations, the paper seems a little complicated at a first glance. Three rations were drawn up, one of which was a normal complete ration, one was similar except that the protein was definitely lower and below the minimum requirement, and the other was again similar except that it was deficient in calcium. Separate groups of pigs were fed on these rations through two or three generations, and great care was taken to ensure that the animals picked up nothing else—*e.g.*, the calcium-deficient pigs had no chance to get a mouthful of soil. The main result of the experiment may be very easily stated. It was found that protein deficiency did not increase the number of degenerate foetuses, and that neither did calcium deficiency raise it noticeably, though it might play the part of a small contributory cause, and it did lead to a greater number of fully developed piglings being born dead.

Other interesting observations were made on the effects of feeding the two abnormal rations. Protein deficiency led to stunting and unthriftiness, and the effects developed to the full at once and got no worse in the succeeding generations. With calcium deficiency, however, things went from bad to worse, and the whole group would probably have died out had the experiment been continued a little longer. The first generation suffered, and the second started life with an inadequate supply, received milk from their mothers which was deficient in this element, and had their condition further aggravated by the ration they received subsequently. Though some of the symptoms shown by this group probably developed as secondary ones, the general condition was one of extreme thriftlessness. Characteristic symptoms were emaciation, coarse hair, scurfy skin, hunched back, overgrown forehead, and protruding eyes. Perhaps the most striking effect of calcium deficiency occurred in connexion with the sows' milk yields; the glands did not develop to anything like the normal

extent, and the very reduced yield of milk was reflected in the poor rate of growth of the young pigs while suckling. In addition, accidents were very common in this group; a number of pigs had to be slaughtered as a result of broken bones, owing to such trivial things as slipping on the floor.

An interesting point noticed in the protein-deficient group was that there was a delay in coming on heat; the average time from weaning the previous litter to the first subsequent heat was nearly five weeks, as compared with approximately two weeks in the other two groups. This would appear on the surface to be in conformity with the results obtained in flushing ewes, where it is found that by high feeding the heat period is advanced, and that protein-rich foods are very efficient in this respect. After a careful consideration of the details, however, Mr. Davidson rejects this explanation. The control ration contained most of its protein in the form of blood meal, which formed some 7 per cent. of the ration, and this was the constituent dropped to obtain the protein-deficient ration. As this meal has a considerable mineral content a mineral mixture was added in its place to make up, but that mixture could not be obtained in the earlier stages of the experiment. When the mineral mixture was not available the delay in coming on heat in the group not receiving blood meal was very marked, but the subsequent addition of the mineral mixture did much to remedy this. Mr. Davidson therefore concluded that the delay in heat was caused by the absence of some mineral or minerals—possibly potassium and iron—which the blood meal provided for the other groups. In support a herd is quoted where there was evidence of mineral deficiency, and where this was accompanied by unduly long intervals between farrowings. It might be added that blood meal was found to cause serious diarrhoea with young pigs, but was considered a fairly useful source of protein for older pigs.

Sows' Milk Yields.—Four German workers have recently published the results of inquiries they have made into the amount and composition of the milk produced by sows in raising litters. In one trial 14 improved German sows produced milk varying from 277 lb. to 490 lb. during a suckling period of 10 weeks; one Berkshire included with this lot gave 482 lb. and so compared well with the German sows. The yield rises slowly for about four weeks (very roughly from 6 lb. to 8 lb. per day) and then tails off. Front teats

yield more than rear ones and there is a correspondingly greater increase in weight of those piglings suckling them, each pigling usually settling down to one particular teat in three or four days and keeping to it. On the average the litter increases nearly 1 lb. in live weight for every 3 lb. of milk. Sow's milk is very rich, as it contains round about 7 per cent. of fat and over 6 per cent. of protein. The composition varies largely from sow to sow and also from teat to teat in the same sow, but there is no definite trend in composition from the fore to the rear teats.

During lactation sows lose largely in their own body weight ; this loss occurs principally in the first few weeks and may amount to anything from 20 lb. upwards. Experiments showed that the sows' loss in body weight was less by 20 per cent., and the milk yield greater by 40 per cent., when a high protein ration (nutritive ration of 1 : 4·9) was fed, than when a low protein ration (nutritive ratio of 1 : 9·2) was used. If the sow is to be highly productive she must not only have a large litter of the right sort of pigs, but must also provide a plentiful supply of milk for them. Except in experiments it is impossible to ascertain how much milk a sow is giving, but the yield is fairly accurately shown by the increases in the weights of the piglings in the first few weeks. The weight of the litter at, say, six weeks old measures both the fertility and the milking capabilities of the sow together (plus an unknown inheritance from the boar). Pig-recording will, therefore, help in picking out the high-milk-yielding sows, and, as far as the experience of the German workers goes, it seems that there is very wide variation, and consequently much chance of effecting an improvement.

DESCRIPTION	Price per qr.		Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.	Price per lb. starch equiv.	Pro- tein equiv.
	s. d.	lb.	£ s.	£ s.	£ s.		s. d.	d.	%
Wheat, British	—	—	6 12	0 11	6 1	72	1 8	0.89	9.6
Barley, British feeding ..	—	—	5 15	0 9	5 6	71	1 6	0.80	6.2
" Danubian	17 0	400	4 15	0 9	4 6	71	1 3	0.67	6.2
" Persian	15 9	"	4 8	0 9	3 19	71	1 1	0.58	6.2
" Russian	16 0	"	4 10*	0 9	4 1	71	1 2	0.62	6.2
Oats, English, white	—	—	6 0	0 9	5 11	60	1 10	0.98	7.6
" black and grey	—	—	5 15	0 9	5 6	60	1 9	0.94	7.6
" Canadian mixed feed ..	12 9	320	4 10*	0 9	4 1	60	1 4	0.71	7.6
" Chilean tawny	14 3	"	5 0	0 9	4 11	60	1 6	0.80	7.6
" German	24 3	"	8 10*	0 9	8 1	60	2 8	1.43	7.6
" Russian	15 0	"	5 5	0 9	4 16	60	1 7	0.85	7.6
Maize, Argentine	20 3	480	4 15	0 9	4 6	81	1 1	0.58	6.8
" South African	18 6	"	4 7½	0 9	3 18	81	1 0	0.54	6.8
Beans, English Winter ..	—	—	5 15½	1 2	4 13	66	1 5	0.76	20
Peas, English Blue	—	—	8 0½	0 19	7 1	69	2 1	1.12	18
" Indian	—	—	9 5†	0 19	8 6	69	2 5	1.29	18
" Japanese	—	—	16 5†	0 19	15 6	69	4 5	2.37	18
Dari	—	—	8 0	0 10	7 10	74	2 0	1.07	7.2
Milling offals—									
Bran, British	—	—	5 5	1 0	4 5	42	2 0	1.07	10
" broad	—	—	6 0	1 0	5 0	42	2 5	1.29	10
Middlings, fine, imported ..	—	—	5 15	0 15	5 0	69	1 5	0.76	12
" coarse, British	—	—	5 5	0 15	4 10	58	1 7	0.85	11
Pollards, imported	—	—	4 10	0 19	3 11	60	1 2	0.62	11
Meal, barley	—	—	6 0	0 9	5 11	71	1 7	0.85	6.2
" maize	—	—	6 2	0 9	5 13	81	1 5	0.76	6.8
" " South African	—	—	5 10	0 9	5 1	81	1 3	0.67	6.8
" " germ	—	—	5 17	0 14	5 3	85	1 3	0.67	10
" locust bean	—	—	6 0	0 7	5 13	71	1 7	0.85	3.6
" bean	—	—	8 15	1 2	7 13	66	2 4	1.25	20
" fish	—	—	18 0	2 18	15 2	53	5 9	3.08	48
Maize, cooked flaked	—	—	7 0	0 9	6 11	83	1 7	0.85	8.6
" gluten feed	—	—	6 7	0 18	5 9	76	1 5	0.76	19
Linseed cake, English, 12% oil ..	—	—	9 12	1 6	8 6	74	2 3	1.20	25
" " " 9% "	—	—	9 1	1 6	7 15	74	2 1	1.12	25
" " " 8% "	—	—	8 17	1 6	7 11	74	2 0	1.07	25
Soya bean cake, 5½% oil ..	—	—	7 7*	1 17	5 10	69	1 7	0.85	36
Cottonseed cake—									
" " English, 4½% oil ..	—	—	4 5	1 5	3 0	42	1 5	0.76	17
" " Egyptian, 4½% " ..	—	—	4 0	1 5	2 15	42	1 4	0.71	17
Decorticated cottonseed meal, 7% oil	—	—	9 5*	1 17	7 8	74	2 0	1.07	35
Ground-nut cake, 6.7% oil ..	—	—	5 5½	1 5	4 0	57	1 5	0.76	27
Decorticated ground-nut cake, 6.7% oil	—	—	7 5½	1 17	5 8	73	1 6	0.80	41
Palm kernel cake, 4½-5½% " ..	—	—	5 15½	0 16	4 19	75	1 4	0.71	17
" " " meal, 4½% " ..	—	—	6 5½	0 16	5 9	75	1 5	0.76	17
" " " meal 1.2% oil ..	—	—	4 12	0 16	3 16	71	1 1	0.58	17
Feeding treacle	—	—	5 15	0 8	5 7	51	2 1	1.12	2.7
Brewers' grains, dried ale ..	—	—	4 2	0 16	3 6	48	1 5	0.76	13
" " " porter	—	—	3 15	0 16	2 19	48	1 3	0.67	13
Malt culms	—	—	5 10†	1 5	4 5	43	2 0	1.07	16
Dried sugar beet pulp (a) ..	—	—	4 15	0 8	4 7	65	1 4	0.71	5.2

* At Bristol.

† At Liverpool.

‡ At Hull.

(a) Carriage paid in 4-ton lots.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of November and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative values of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, if palm kernel cake is offered locally at 57 per ton, then since its manurial value is 16s. per ton as shown above, the cost per unit of starch equivalent is 1s. 8d. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 1s. 8d. Dividing this again by 22.4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 0.99d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculation a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own markets. The figures given in the table under the heading manurial value per ton are calculated on the basis of the following unit prices:—N., 8s. 3d.; P₂O₅, 2s. 11d.; K₂O, 3s. 3d.

Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follow :—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (imported)	71	6.2	4 11
Maize	81	6.8	4 11
Decorticated ground nut cake	73	41.0	7 5
„ cotton cake	71	34.0	7 0

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 1.17 shillings, and per unit protein equivalent, 1.81 shillings. An explanation of the method of calculation employed is given in the Report of the Departmental Committee on Rationing of Dairy Cows.*

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The “food values” which it is recommended should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows are given in the November, 1930, issue of the Ministry's JOURNAL.)

FARM VALUES

Crops	Starch equivalent Per cent.	Protein equivalent Per cent.	Food value per ton, on farm £ s.
Wheat	72	9.6	5 2
Oats	60	7.6	4 4
Barley	71	6.2	4 14
Potatoes	18	0.6	1 2
Swedes	7	0.7	0 9
Mangolds	7	0.4	0 9
Beans	66	20.0	5 13
Good meadow hay	37	4.6	2 12
Good oat straw	20	0.9	1 5
Good clover hay	38	7.0	2 17
Vetch and oat silage	13	1.6	0 18
Barley straw	23	0.7	1 8
Wheat straw	13	0.1	0 15
Bean straw	23	1.7	1 10

* Obtainable from H.M. Stationery Office, Adastral House, Kingsway, W.C. 2. Price 6d. net.

* * * * *

MISCELLANEOUS NOTES

THE International Institute of Agriculture at Rome has recently published the 1929-30 edition of the International Year Book of Agricultural Statistics.

**The
International
Year Book of
Agricultural
Statistics**

This volume of about 800 pages is the result of the most extensive and detailed inquiry made in the domain of international agricultural statistics and constitutes a work of the greatest importance to all those who are interested in questions having a direct or indirect relation to the production of and commerce in agricultural products.

Figures for area and population of 220 countries, in the years nearest to 1913 and 1929, are classified in the first part of the Year Book. The presentation of these figures throws light upon the world situation from the geographical and political points of view during both the pre-war and post-war periods. The second part of the Year Book is composed of a series of tables comprising for nearly 50 countries the available data concerning the uses for which the total area is employed, the apportionment of cultivated areas between the different crops, agricultural production, numbers of the different kinds of livestock and the products derived from them. In the tables constituting the third part of the volume, the area, production and yield per acre in each country during the last five years of the pre-war period and during each of the years from 1926 to 1929 for nearly 40 agricultural products have been given.

For each kind of livestock, all available figures in the different countries have been grouped for the years 1913 and 1925 to 1929. A large part of the volume is devoted to statistics of the commercial movement of 42 vegetable products and 12 products of animal origin. The figures published relate to the imports and exports during the calendar years and for the cereals also during the commercial seasons.

It may be added that the tables of production and commerce not only specify details for each country but also the totals for the different continents and hemispheres and for the whole world, and give a general idea of the changes taking place during the periods under consideration in the area under each crop, quantities harvested and the commercial movement in each product.

The part devoted to prices contains the weekly quotations of 25 agricultural products on the principal world markets for the year 1913 and for the period January, 1926, to June, 1930. In the freights section will be found the quotations for the carriage of wheat, maize and rice on the most important shipping routes, and in the section reserved for fertilizers and chemical products useful in agriculture are published statistics of production, trade and prices for 15 products. In the rates of exchange section are set out the rates on the New York exchange for the most important currencies.

For the first time there have been introduced into the volume special chapters on the importance and distribution of the agricultural population, and the distribution of agricultural holdings according to their size and mode of tenure and forestry.

Copies of the latest volume may be purchased from the Ministry (price 25s.).

* * * * *

PRICES of agricultural produce during November were on average 29 per cent. higher than in the corresponding month of the base years 1911-13 and the same

The Agricultural Index Number as a month earlier, but 15 points below the level recorded in November, 1929.

During the period under review the index figure for most descriptions of produce showed a decrease, but these reductions were counterbalanced by increases in fat pigs, potatoes and milk.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1925 :—

Month	Percentage increase compared with the average of the corresponding month in 1911-13.					
	1925	1926	1927	1928	1929	1930
January	71	58	49	45	45	48
February	69	53	45	43	44	44
March	66	49	43	45	43	39
April	59	52	43	51	46	37
May	57	50	42	54	44	34
June	53	48	41	53	40	31
July	49	48	42	45	41	34
August	54	49	42	44	52	35
September	55	55	43	44	52	42
October	53	48	40	39	42	29
November	54	48	37	41	44	29
December	54	46	38	40	43	—

Grain.—Quotations for both wheat and oats declined by 3d. per cwt. and the index numbers were lower by 4 and 5 points respectively at 11 and 17 per cent. below pre-war levels. In the case of barley, a fall of 2d. per cwt. was recorded, and the index figure was reduced by 2 points to 11 per cent. above 1911-13. As compared with a year ago, wheat was cheaper by 2s. 8d. per cwt. and oats by 1s. 7d., but the average for barley was unchanged.

Live Stock.—Values for fat cattle receded further in November, and the average showed a drop of fully 1s. per live cwt., the index number being 3 points lower on the month at 28 per cent. above pre-war. Fat sheep also sold at rather easier prices, and the index figure declined by 9 points to 53 per cent. in excess of the base years. Bacon pigs showed a slight recovery from the level ruling in October, and the index figure appreciated by 4 points to 29 per cent. above 1911-13, while quotations for porkers advanced further, the index number being 5 points higher at 50 per cent. in excess of pre-war. As compared with November, 1929, bacon pigs were about 2s. 8d. and porkers 2s. 3d. per score cheaper. Values for dairy cows were about 10s. per head higher than in October, and averaged 31 per cent. more than in the base years. Store cattle, however, sold at rather lower prices, and the index figure fell by 4 points to 23 per cent. above 1911-13. Although a rise of close on 2s. 6d. per head was recorded for store sheep, this increase was proportionately less than that which occurred between October and November of the base years, with the result that the index number showed a drop of 6 points to 56 per cent. in excess of pre-war. In the case of store pigs, however, the fall in price during the month under review was not so severe as that recorded in the corresponding period of 1911-13 and the index figure was 4 points higher at 111 per cent. over pre-war.

Dairy and Poultry Produce.—In most districts, the contract price of milk during November was much the same as that ruling in October, but in the Manchester area a considerable seasonal rise was recorded, causing the index figure to advance by 10 points to 57 per cent. above pre-war. Butter prices were about unchanged, but the index number was 4 points lower. Cheese, on the other hand, was slightly dearer, but as the increase was proportionately less than in the corresponding period of 1911-13, the index fell by 1 point to 16 per cent. above pre-war. Values for eggs continued to rise, but for the same reason as in the case of cheese the index

number was 23 points lower at 33 per cent. above pre-war. At the corresponding period a year ago, the index for eggs fell by 27 points to 54 per cent. over 1911-13. Poultry was a little cheaper at 36 per cent. more than pre-war.

Other Commodities.—Potato prices were about 2s. 6d. per ton higher in November than in October, and the index number rose by 6 points to 46 per cent. above the level of the base years, which compares with a figure of only 18 per cent. in November, 1929. Quotations for hay continued to decline, the reductions during November amounting to about 3s. 6d. per ton and the index number was reduced by a further 3 points to 7 per cent. below the pre-war level; a year earlier there was a rise of 1 point to 41 per cent. above pre-war. Apples were rather dearer at an average of 34 per cent. above 1911-13, but the general index for vegetables showed little change, increases in cauliflowers and celery being counter-balanced by reductions in most other descriptions. Wool prices were again lower on the month and the index figure fell by 5 points to 17 per cent. below pre-war.

Index numbers of different commodities during recent months and in November, 1928 and 1929, are shown below :—

Percentage increase as compared with the average
prices ruling in the corresponding months of
1911-13.

Commodity	1928	1929	1930			
	Nov.	Nov.	Aug.	Sept.	Oct.	Nov.
Wheat	31	24	4	—3*	—7*	—11*
Barley	25	11	—12*	3	13	11
Oats	27	6	—13*	—12*	—12*	—17*
Fat cattle	31	33	37	35	31	28
„ sheep	53	53	62	62	62	53
Bacon pigs	24	56	41	33	25	29
Pork „	33	70	50	44	45	50
Dairy cows	38	33	35	31	30	31
Store cattle	20	15	30	27	27	23
Store sheep	53	51	66	69	62	56
Store pigs	31	108	112	107	107	111
Eggs	51	54	40	36	56	33
Poultry	47	43	43	40	39	36
Milk	71	67	58	100	47	57
Butter	52	50	33	24	14	10
Cheese	78	32	28	22	17	16
Potatoes	53	18	25	51	40	46
Hay	4	41	15	11	—4*	—7*
Wool	66	41	—5*	—8*	—12*	—17*

* Decrease.

NUMBER and declared value of animals, living, for breeding, exported from Great Britain and Northern Ireland during the three months ended September, 1930, compared with the corresponding period of 1929. (From returns supplied by H.M. Customs and Excise.)

Country to which exported	July to Sept., 1930		July to Sept., 1929	
	Number	Declared value	Number	Declared value
CATTLE		£		£
Argentina	33	4,716	22	3,550
Belgium	145	3,380	0	0
Brazil	1	100	12	969
Chile	1	1,050	1	945
United States of America	29	2,441	0	0
Uruguay	14	3,445	13	3,500
Australia	0	0	15	3,118
Canada	1	80	175	15,351
Irish Free State ..	409	8,808	531	11,827
Southern Rhodesia ..	0	0	28	1,857
Union of South Africa ..	11	921	2	85
Other countries ..	24	1,505	30	1,131
Total	668	26,446	829	42,333
SHEEP AND LAMBS				
Argentina	203	3,500	166	4,140
Brazil	10	150	50	1,583
Chile	5	101	59	2,745
France	39	543	147	1,500
United States of America	69	1,127	8	507
Uruguay	162	3,174	78	2,361
Australia	12	333	80	2,214
Canada	37	367	264	2,448
Irish Free State ..	199	1,081	309	958
Other countries ..	34	629	28	478
Total	770	11,005	1,189	18,934
SWINE				
Argentina	0	0	21	280
Denmark	12	270	18	354
Greece	6	175	1	11
Hungary	0	0	37	783
Japan	16	442	0	0
Poland	2	84	19	329
Australia	5	180	13	564
Canada	0	0	21	325
Irish Free State ..	127	2,139	102	645
Other countries ..	35	652	21	524
Total	203	3,942	253	3,815

UNDER the Local Government Act, 1929, the railway companies were relieved of a proportion of their local rates on the condition that the sums thus saved were used in giving rebates from the carriage charges on certain selected traffics.

**Railway
Freight Rebate
Scheme**

These traffics included most of the fertilizers and feeding stuffs in common use, milk, potatoes, and livestock, and one-fifth of the net fund available for rebates was allocated to these agricultural traffics.

During the first year of the operation of this permanent scheme, the rebate allowed on all these traffics was 10 per cent. of the railway freight charge, but at the annual review held in November last, the Railway Rates Tribunal found it possible to increase the rebate for the current year to $12\frac{1}{2}$ per cent. The selected agricultural traffics, when sent by goods train (or, in the case of milk, by passenger train) are, therefore, now subject, as from December 1, 1930, to a freight rebate of $12\frac{1}{2}$ per cent.

IN connexion with the International Conference on Phytopathology and Economic Entomology held in Holland in 1923 prizes were offered in 1928 for the

**Eriksson
Prizes**

two best memoirs concerning (1) Investigations on Rust Diseases (Uredineæ) of Cereals, and (2) Investigations on the Role played by Insects or other Invertebrates in the Transmission or Initiation of Virus Diseases in Plants, the prizes being of the value of 1,000 Swedish crowns (about £55) each. It is now announced that the prize for the most meritorious investigations on Rusts has been awarded to Mr. J. H. Craigie, Senior Plant Pathologist in Charge, Dominion Rust Research Laboratory, Winnipeg, Manitoba, Canada. Mycologists will recollect that it was Mr. Craigie who recently discovered the hitherto unknown and important function of the spermogonia of the Rust fungi. The adjudicators have made no award in connexion with the subject for the second prize.

Farm Workers' Minimum Wages.—Meetings of the Agricultural Wages Board were held on November 18 and December 16, at 7 Whitehall Place, London, S.W. 1.

The Board considered notifications from Agricultural Wages Committees of decisions fixing minimum and overtime rates of wages and proceeded to make the following Orders carrying these decisions into effect.

Berkshire.—An Order continuing the operation of the existing minimum and overtime rates of wages from December 21, 1930, until December 19, 1931. The minimum rates in the case of male workers of 21 years of age and over are 30s. per week of 41 hours in the weeks in which Christmas Day and Good Friday fall and 50 hours in any other week, with overtime at 8½d. per hour. In the case of female workers of 19 years of age and over the minimum rate is 5d. per hour for all time worked.

Cornwall.—An Order continuing the operation of the existing minimum and overtime rates of wages from December 21, 1930, until December 19, 1931. The minimum rates in the case of male workers of 21 years of age and over are 32s. per week of 33 hours in the week in which Christmas Day and Boxing Day fall, 42 hours in the weeks in which Good Friday and Whit Monday fall and 51 hours in any other week, with overtime at 9d. per hour on weekdays and 10d. per hour on Sundays. In the case of female workers of 20 years of age and over the minimum rate is 5d. per hour for all time worked.

Derbyshire.—An Order continuing the operation of the existing minimum and overtime rates of wages from December 26, 1930, until December 25, 1931. The minimum rate in the case of male workers of 21 years of age and over is 8d. per hour for a week of 54 hours with overtime at 10d. per hour for Sunday work. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour on weekdays with overtime at 8d. per hour for employment on Sunday.

Hampshire and Isle of Wight.—An Order continuing the operation of the existing minimum and overtime rates of wages from December 21, 1930, until December 19, 1931. The minimum rates in the case of male workers of 21 years of age and over is 30s. 6d. per week of 40½ hours in the week in which Christmas Day falls and 48 hours in any other week in winter; 41½ hours in the week in which Good Friday falls and 51 hours in any other week in summer. The Order provides that in the case of a worker who is given a clear day's holiday in the week following that in which Good Friday falls the number of hours in respect of which the minimum weekly wage is payable shall be 51 in the week in which Good Friday falls and 41½ in the following week. The overtime rate in the case of male workers of 21 years of age and over is 8d. per hour except in the case of the employment of carters, cowmen, shepherds or milkers on work in connection with the immediate care of animals when the overtime rate is 7½d. per hour. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour for all time worked.

Norfolk.—(1) An Order to come into operation on December 28, 1930, when the existing rates are due to expire, and continuing in force until December 26, 1931. The minimum rates in the case of male workers of 21 years of age and over are 30s. per week of 42 hours in the week in which Good Friday falls and 50 hours in any other week in summer, 40 hours in the week in which Christmas Day falls and 48 hours in any other week in winter, with, in addition, in

the case of teamsmen, cowmen, shepherds and yardmen, 5s. 6d. per week, and in the case of sheep tenders and bullock tenders 4s. 6d. per week to cover employment in excess of those hours on duties in connexion with the immediate care of animals except on Good Friday and Christmas Day. In respect of work in connexion with the immediate care of animals on Good Friday and Christmas Day an additional sum of 5s. is payable in regard to each of those days except in any case in which a clear day's holiday on full pay is given either in the week in which those holidays fall or in the following week. The overtime rates in the case of all classes of male workers of 21 years of age and over are 9d. per hour on weekdays and 11d. per hour on Sundays. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour with overtime at 6½d. per hour on weekdays and 7½d. per hour on Sundays.

(2) An Order fixing special minimum and overtime rates of wages for male workers employed on the corn harvest in 1931. In the case of workers of 21 years of age and over employed throughout the harvest the wage payable in respect of the harvest is an inclusive sum of £11. In the case of workers who are not employed for the full harvest period special differential rates have been fixed for overtime employment on the corn harvest, the rate in the case of workers of 21 years of age and over being 9½d. per hour.

Somerset.—An Order continuing the operation of the existing minimum and overtime rates from December 21, 1930, until December 19, 1931. The minimum rates in the case of male workers of 21 years of age and over are 32s. per week of 32½ hours in the week in which Christmas Day and Boxing Day fall, and 50 hours in any other week in winter; 42½ hours in the weeks in which Good Friday, Easter Monday and Whit Monday fall, and 52 hours in any other week in summer. Provision is made for the modification of the hours of work in certain weeks where holidays are given in lieu of any of the public holidays mentioned. The overtime rate in the case of male workers of 21 years of age and over is 9d. per hour except for employment on the hay and corn harvests when the rate is 10d. per hour. In the case of female workers of 21 years of age and over the minimum rate is 6d. per hour for all time worked.

Surrey.—An Order continuing the operation of the existing minimum and overtime rates from December 21, 1930, until December 19, 1931. The minimum rates in the case of male workers of 21 years of age and over are : horsemen, stockmen or shepherds 38s. 8d. per week of 51 hours in the weeks in which Christmas Day and Good Friday fall and 60 hours in any other week; other male workers (except casual workers) 32s. 3d. per week of 41 hours in the weeks in which Christmas Day and Good Friday fall and 50 hours in any other week; casual workers, 7½d. per hour. Provision is made for the payment of the minimum weekly wage except in the case of casual workers in respect of a reduced number of hours in Easter week instead of in the week in which Good Friday falls if a holiday is given on Easter Monday in lieu of a holiday on Good Friday. The overtime rates in respect of all classes of male workers of 21 years of age and over are 10d. per hour on weekdays and 11½d. per hour on Sundays. In the case of female workers of 18 years of age and over the minimum rate is

5½d. per hour with overtime at 7d. per hour on weekdays and 8d. per hour on Sundays.

Wiltshire.—An Order continuing the operation of the existing minimum and overtime rates of wages from December 21, 1930, until December 19, 1931. The minimum rates in the case of male workers of 21 years of age and over are 30s. per week of 39½ hours in the week in which Christmas Day falls, 48 hours in any other week in winter, 41 hours during the week in which Good Friday falls and 50 hours in any other week in summer, with overtime at 8d. per hour except for overtime employment on harvest work in the hay and corn harvests when the rate is 9d. per hour. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour for all time worked.

East Riding of Yorkshire.—An Order to come into operation on November 24, 1930 (*i.e.*, the day following that on which the present rates are due to expire), and to continue in force until November 23, 1931. The rates in the case of male workers engaged by the year and boarded and lodged by their employer are: foremen, £81 12s. 0d.; beastmen and shepherds, £73 19s. 0d.; waggoners, £71 8s. 0d., with lesser rates for lads and beginners. These rates are payable in respect of a year consisting of 51 weeks of the following number of hours; in the week in which Good Friday falls 43, in any other week in summer 52½, in the week in which Christmas Day falls 39½ and in any other week in winter 48, with, in addition, in each case, not more than 12 hours per week on weekdays and 3 hours on Sundays spent on work in connexion with the care of and attention to stock. In the case of other male workers boarded and lodged by their employer the minimum rates per week are: foremen, 32s.; beastmen and shepherds, 29s.; waggoners, 28s., with lesser rates for lads and beginners, these rates being payable in respect of the same number of hours per week as in the case of workers engaged by the year. The minimum rate for male workers of 21 years and over who are not boarded and lodged by their employer is 35s. (instead of 36s. as at present) per week of 48 hours in winter and 52½ hours in summer, except that in the week in which Christmas Day falls the hours for which the minimum wage is payable are 39½, and that in the week in which Good Friday falls the hours are 43. The overtime rates for all classes of male workers of 21 years of age and over are 10d. per hour on weekdays and 1s. per hour on Sundays, Good Friday and Christmas Day. In the case of female workers of 18 years of age and over the minimum rate is 6d. per hour with overtime at 9d. per hour.

North Riding of Yorkshire.—An Order cancelling as from November 23, 1930, the existing minimum and overtime rates and fixing fresh rates as from November 24, 1930, to continue in force until further notice. The minimum rate in the case of male workers of 21 years of age and over is 33s. (instead of 34s. as at present) per week of 48 hours in winter and 52½ hours in summer with, in addition, payment at 3d. per hour in the case of workers who are boarded and lodged by the employer and 6d. per hour for workers who are not so boarded and lodged in respect of employment in excess of those hours in the care of and attendance upon animals. The minimum rate for male casual workers of 18 years of age and over is 6d. per hour for all time worked. The overtime rates of wages for male workers of 21 years of age and over, other than casual workers, are 10d. per hour on weekdays and 1s. per hour

on Sundays. In the case of female workers of 18 years of age and over the minimum rate is 6d. per hour for a week of 44 hours with overtime at 9d. per hour.

Radnor and Brecon.—An Order varying the minimum and overtime rates of wages as from January 1, 1931. The minimum rate in the case of male workers of 21 years of age and over is 31s. per week of 54 hours in summer and 50 hours in winter (instead of 48 hours in winter as at present) with overtime at 9d. per hour. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour with overtime at 6½d. per hour on weekdays and 7½d. per hour on Sundays. These rates will continue in operation until April 30, 1931.

Copies of the Orders in full may be obtained on application to the Secretary of the Agricultural Wages Board.

* * * * *

Enforcement of Minimum Rates of Wages.—During the month ending December 13 legal proceedings were instituted against 14 employers for failure to pay the minimum rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases are as follows :—

County	Court	Fines			Costs			Arrears of wages			No. of workers involved
		£	s.	d.	£	s.	d.	£	s.	d.	
Gloucester ..	Cheltenham ..	8	0	0	3	13	6	50	19	3	3
" ..	" ..	2	0	0	2	4	6	11	6	0	1
" ..	Stroud ..	20	0	0	0	16	0	49	5	3	2
Lancaster ..	Chorley ..	1	0	0	2	2	0	26	10	0	4
Worcester ..	Shipston-on- Stour	8	0	0	2	7	0	36	8	2	2
Yorks, N.R.	Flaxton ..	*			--			--			1
Yorks, W.R.	Rotherham	4	0	0	1	1	0	26	10	0	1
" ..	" ..	10	0	0	2	2	0	54	0	0	2
" ..	" ..	†			0	8	0	10	0	0	1
" ..	" ..	3	0	0	0	7	6	24	7	3	2
" ..	" ..	1	0	0	1	1	0	12	10	0	1
" ..	Sheffield ..	8	0	0	—			40	0	0	2
Carmarthen	Carmarthen	1	0	0	—			10	10	0	1
Flint ..	Holywell ..	†			0	4	6	21	0	0	1
		£66	0	0	£16	7	0	£373	5	11	24

* Case dismissed.

† Dismissed under Probation of Offenders Act.

* * * * *

Foot-and-Mouth Disease.—No further outbreaks have occurred in Great Britain since the confirmation of the outbreak at Lockwood, Huddersfield, Yorks (West Riding), on November 10—referred to in the November issue of this JOURNAL. The restrictions imposed in consequence of that outbreak were withdrawn on December 2. The position, as this issue goes on to press, is that as from the latter date no general movement restrictions have been in force in connexion with foot-and-mouth disease in any part of Great Britain.

APPOINTMENTS

COUNTY AGRICULTURAL EDUCATION STAFFS : ENGLAND

Cambridgeshire : Mr. G. W. Channon, N.D.A., N.D.D., B.D.F.D., and Mr. J. R. Scott, B.Sc., have been appointed Assistant Agricultural Instructors.

Mr. K. V. Cramp,* R.H.S. Diploma, has been appointed Assistant Horticultural Instructor.

Somerset : Mr. R. A. Engledow has been appointed Instructor in Gardening and Head Gardener, *vice* Mr. K. V. Cramp, R.H.S. Diploma.

Mr. F. R. Wallburton has been appointed Assistant Instructor in Poultry Keeping, *vice* Mr. H. F. Burdett.

Mr. W. S. Turner has been appointed Manager of the County Egg-Laying Trials, *vice* Mr. J. F. Siderfin.

Yorkshire (Agricultural Department, University of Leeds) : Miss M. J. Carter, B.Sc., N.D.P., and Miss J. McL. Millar, N.D.D., have been appointed Assistant Lecturers in Poultry Husbandry.

Miss E. G. Steward, N.D.P., Assistant Lecturer in Poultry Husbandry, has left the service of the Authority.

* *Wholly employed by the County Council, but only partially on agricultural education work.*

WALES

Glamorganshire : Mr. Frederick Blakemore has been appointed Instructor in Veterinary Science.

Mr. E. Ll. Harry has been appointed Instructor in Agricultural Economics.

Mr. William Williams has been appointed Instructor in Agriculture.

Mr. H. R. Jenkins has been appointed Instructor in Small Live Stock.

The above are new posts under the Extension Scheme.

Mr. William Evans (Poultry Instructor for Carmarthenshire) has been appointed Instructor in Poultry Husbandry *vice* Mr. G. E. Reddaway, who has resigned.

Montgomeryshire : Mr. Oswald Bowen has been appointed Instructor in Poultry Keeping.

This is a new appointment under the Extension Scheme.

NOTICES OF BOOKS

Manual of Bacterial Plant Pathogens. By Charlotte Elliott. (London : Baillière, Tindall & Cox. Pp. ix + 349. Price 22s. 6d. net.)

When one visits certain of the scientific establishments in the United States of America, one is struck with the ubiquity and utility of the roll top desk, the expanding book case, and the card index cabinet. Out of one of the last-named, the present volume has emerged. It constitutes a kind of detailed "Who's Who" concerning the various bacterial parasites of plants and their associated non-pathogenic forms. The first part of the book, covering over 250 pages, contains a list of bacterial plant pathogens, arranged according to genera in alphabetical order, whilst the non-pathogenic organisms associated with plant diseases follow in a similar section, comprising some 40 pages or so. In a third section the organisms are arranged in the form of a chronological chart, covering some 10 pages. In this are to be

found details such as the date on which the organism was named, its host, its size, its thermal deathpoint and its response to several characteristic, differentiating tests.

Finally, there is an index which includes the names of the host plants and of the bacteria dealt with in the text. In one respect the index is perhaps not so satisfactory as the rest of the book. With those hosts, as well as with those parasites, that are mentioned frequently in the text, one is provided solely with a series of numbers, referring to pages, without any further clue as to what particular aspect of host or parasite is dealt with on any given page. Under Potato, for instance, there are no fewer than 66 page entries; under *Bacillus carotovorus* there are no fewer than 63. It would have meant a little more labour, in such cases, to have indicated very briefly the type of information concerning host or parasite to be found on each page, but it would have been a great help to the user of the book. Even to have indicated, by a change in type-font, the particular page on which the main section dealing with a given organism began, would have been a considerable advantage.

The succinct information supplied concerning each organism in the alphabetical lists appears to be ample, and the literature lists, which are arranged in chronological order, appear to be practically exhaustive and, on the whole, up to date, some of the references, indeed, being to work published in 1930, the year in which the book itself was published. A random test, however, suggests that absolute perfection in this respect has not been attained; and it is, of course, scarcely to be expected. Thus, looking up, by chance, Paine's *Pseudomonas solaniolens* in the index (in the specific name of which there happens to be a misprint!) one finds on the appropriate page the principal literature references to what has hitherto been published in connexion with "Spraing" of potatoes. Although, however, the latest entry is dated 1930, there is a paper by Burr in 1928 and one by Fruwirth in 1929 that are not included. Possibly similar slight omissions might be found in other instances, but, if so, they need not be looked upon as seriously minimizing the value of the book. Plant pathologists, especially those who are particularly interested in bacterial diseases, will welcome this detailed directory of their organisms, and will find the volume a tool calculated to save them much time and labour in securing information on the organisms themselves and on the original sources from which it has been derived. It should certainly be amongst the books on their shelves.

Practical Poultry Management. By J. E. Rice, B.S., and H. E. Botsford, B.S. Second edition. Illustrated. Pp. xvii + 540. (New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. 1930. Price 13s. 6d. net.)

The rapid expansion of the poultry industry during recent years has produced an extensive and many-sided literature of the subject, especially in the United States of America, where the output of specialist publications has assumed large proportions. Directly or otherwise, so many branches of science have a bearing on poultry-keeping, and so numerous are the problems confronting the modern poultry-keeper, that it has become practically impossible to deal adequately with the subject as a whole in a single volume. While the present work cannot claim to be a comprehensive and detailed treatise on poultry in general, it deals in a concise and readable manner with the main facts, principles and natural laws underlying their successful management. The chapters devoted to culling, incubation, selection, housing, feeding, exhibiting and judging, although primarily applicable to American conditions,

will repay study by the British poultry-keeper, while the information regarding the anatomy and physiology of the domestic fowl, and diagnosis and treatment of disease, is sound and simply phrased, as well as eminently practical. Despite its transatlantic flavour, this is a book that should prove useful to British poultry-keepers who wish to bring their practice up to date.

The Agricultural Crisis and the Way Out. By C. Brereton, M.A., L. ès L., D. ès Lettres. With Preface by Lord Ernle, P.C., M.V.O. Pp. 47. (Norwich: Jarrold and Sons, Ltd., London Street. Price 3d.)

This is a reprint of articles by a well-known landowner which appeared recently in the *Eastern Daily Press*, their object being "to set before the general public in as dispassionate a way as possible the desperate plight of arable farming and fruit-growing, and especially to bring home to the urban population the parlous state of a great industry with whose fortunes their own are intimately bound up." The causes which have brought about the present situation are analysed, and the proposed remedies and palliatives reviewed. The author stresses the urgency of the problem. His proposals include a guaranteed price for wheat, a duty on foreign malting barley, control by licence or otherwise of foreign imports combined with voluntary rationing of the amount of home production and the extension of marketing schemes.

* * * * *

SELECTED CONTENTS OF PERIODICALS

Grass Land

Notes on Intensive Cultivation of Grassland. *W. Low.* (Trans. Highl. Agric. Soc. Scot., xlii, 1930, pp. 113-117.) [63.33-16; 63.33.]

High Protein Pasture. *F. T. Shutt.* (Chem. and Ind. (Jour. Soc. Chem. Ind.), 49, 33 (August 15, 1930), pp. 679-681.) [63.33-16; 63.33; 63.60433.]

A Botanical Study of Pasture Plots. *E. Wyllie Fenton.* (Ann. App. Biol., xvii, 3 (Aug., 1930), pp. 522-548.) [63.33.]

The Effect of Pigs upon Grassland. *V. C. Fishwick.* (Jour. S.E. Agric. Coll., Wye, No. 27 (1930), pp. 180-181.) [63.33; 63.64.]

Horticulture

The Effect of Certain Treatments on the Germination of Tomato Seeds. *Mary Jozefowicz.* (Ann. App. Biol., xvii, 3 (Aug., 1930), pp. 504-513.) [63.1951; 63.513.]

Some Observations on Tomato Plants from Seed submitted to High Temperatures. *Mary Jozefowicz.* (Ann. App. Biol., xvii, 3 (Aug., 1930), pp. 514-521.) [63.1951; 63.513.]

The Root System of Fruit Tree Seedlings. *V. A. Kolesnikov.* (Jour. Pom. and Hort. Sci., viii, 3 (Aug., 1930), pp. 197-203.) [63.41.]

The Dying Off of Rootlets of Fruit Trees. *V. A. Kolesnikov.* (Jour. Pom. and Hort. Sci., viii, 3 (Aug., 1930), pp. 204-209.) [63.41.]

Rootstock and Scion Relationship. Some Effects of Scion Variety upon the Rootstock. *T. Swarbrick.* (Jour. Pom. and Hort. Sci., viii, 3 (Aug., 1930), pp. 210-228.) [63.41.]

The Effect of Scion on Root. II.—Stem-worked Apples. *J. Amos, R. G. Hatton and T. N. Hoblyn.* (Jour. Pom. and Hort. Sci., viii, 3 (Aug., 1930), pp. 248-258.) [63.41.]

The Effect of Scion on Root. III.—Comparison of Stem and Root-worked Trees. *M. C. Vyvyan.* (Jour. Pom. and Hort. Sci., viii, 3 (Aug., 1930), pp. 259-282.) [63.41.]

- The Winter Shoots of Apple Trees. Their Use in the Identification of Varieties. *R. T. Pearl*. (Jour. S.E. Agric. Coll., Wye, No. 27 (1930), pp. 74-86.) [63.41.]
- The Nutrition of Fruit Trees. I.—Some Effects of Deficiencies of Essential Elements on Fruit Trees. *T. Wallace*. II.—Response of Apple Trees on Known Rootstocks to Applications of a Complete Fertilizer. *J. Amos, R. G. Hatton and T. N. Hoblyn*. III.—The Reaction to Potash Fertilizers of Apple Trees in the Field. *N. H. Grubb*. IV.—Some Observations upon the Growth and Seasonal Cycle of Food Reserves in Apple Trees. *T. Swarbrick* (from the Proceedings of the Association of Economic Biologists, II., March 21, 1930). (Ann. App. Biol., xvii, 3 (Aug., 1930), pp. 649-686.) [63.41; 63.41-16.]
- The Study of Pollination in Relation to Cherry Orchards. *C. H. Hooper*. (Jour. S.E. Agric. Coll., Wye, No. 27 (1930), pp. 202-204.) [63.41-08; 63.41.]

Plant Pests and Diseases

- The Physiology of Virus Diseases in Plants. I.—The Movement of Mosaic in the Tomato Plant. *J. Caldwell*. (Ann. App. Biol., xvii, 3 (Aug., 1930), pp. 429-443.) [63.23.]
- The Role of *Thrips tabaci* Lindeman in the Transmission of Virus Diseases of Tomato. *Phyllis H. Jarrett*. (Ann. App. Biol., xvii, 3 (Aug., 1930), pp. 444-451.) [63.23; 63.27; 63.512.]
- A Study of the Degeneration of Certain Potato Stocks. *T. Whitehead*. (Ann. App. Biol. xvii, 3 (Aug., 1930), pp. 452-486.) [63.23; 63.512.]
- Notes on the Culturing of Insects for Virus Work. *Marion A. Hamilton*. (Ann. App. Biol., xvii, 3 (Aug., 1930), pp. 487-492.) [63.23; 63.29.]
- The Influence of Environmental Conditions on the Development of the Angular Leaf-spot Disease of Cotton. II.—The Influence of Soil Temperature on Primary and Secondary Infection of Seedlings. *R. H. Stoughton*. (Ann. App. Biol., xvii, 3 (Aug., 1930), pp. 493-503.) [63.23.]
- Leaf Stripe or Yellow Leaf of Oats. *D. G. O'Brien and E. G. Prentice*. (Scot. Jour. Agric., xiii, 3 (July, 1930), pp. 272-284.) [63.24.]
- Strawberry Disease in Lanarkshire. Part I.—Field Investigations. *D. V. Howells*. Part II.—Phytophthora Disease. *N. L. Alcock and C. E. Foister*. (Scot. Jour. Agric., xiii, 3 (July, 1930), pp. 242-251.) [63.24; 63.24-41.]
- The Control of Apple Scab. I.—Bramley's Seedling and Newton Wonder. *N. B. Bagenal, W. Goodwin, E. S. Salmon and W. M. Ware*. II.—Allington Pippin and Newton Wonder. *W. Goodwin, E. S. Salmon and W. M. Ware*. (Jour. S.E. Agric. Coll., Wye, No. 27 (1930), pp. 186-201.) [63.24.]
- The Incidence and Control of Apple Scab and Apple Mildew at East Malling. Part I.—Apple Scab. *M. H. Moore*. (Jour. Pom. and Hort. Sci., viii, 3 (Aug., 1930), pp. 229-247+4 pl.) [63.24.]
- Apple Scab at East Malling. *M. H. Moore*. (Ann. Rept., East Malling Res. Stn., 1929 (Part I.—General), pp. 72-75.) [63.24.]
- The Control of the Fruit Tree Red Spider on Plum. *A. M. Massee*. (Ann. Rept., East Malling Res. Stn., 1929 (Part I.—General), pp. 85-88.) [63.27.]
- The Apple Blossom Weevil: The Results of Further Investigation upon its Control. *A. M. Massee*. (Ann. Rept., East Malling Res. Stn., 1929 (Part I.—General), pp. 89-93.) [63.27.]

- Studies on *Oscinella frit* Linn. Comparative Records of Oat Grain Infestation in Sweden during the year 1927, together with a Note on Sterility or "Blindness" of Grain. *N. Cunniffe*. (Ann. App. Biol., xvii, 3 (Aug., 1930), pp. 549-553.) [63.27; 63.314.]
- The Control of Codlin Moth in Australia: Notes on the Possible Utilization of Trichogramma (Hym. Chalcidoidea). *J. W. Evans*. (Jour. Coun. Sci. Ind. Res. (Australia), iii, 2 (May, 1930), pp. 106-116.) [63.296.]
- Notes on Myriapoda. XXXIII.—The Economic Status of Diplopoda and Chilopoda and their Allies, especially of forms occurring in the British Isles, particularly those of importance in Agriculture and Horticulture. *S. G. Brade-Birks*. (Jour. S.E. Agric. Coll., Wye, No. 27 (1930), pp. 103-146.) [63.27.]
- Field Experiments on the Control of the Apple Capsid (*Plesiocoris rugicollis* Fall.) and the Common Green Capsid (*Lygus pabulinus* Linn.) during 1929. *M. D. Austin*. (Jour. S.E. Agric. Coll., Wye, No. 27 (1930), pp. 147-179.) [63.27.]
- On the Resistance of Basket Willows to Button Gall Formation. *H. F. Barnes*. (Ann. App. Biol., xvii, 3 (Aug., 1930), pp. 638-640.) [63.27; 63.3412.]
- The Utility of Mathematical Methods in Relation to Work on Biological Control. *W. R. Thompson* (from the Proceedings of the Association of Economic Biologists. I. Feb. 21, 1930). (Ann. App. Biol., xvii, 3 (Aug., 1930), pp. 641-648.) [63.296.]
- The Insecticidal Action of some Derivatives of Pyridine and Pyrrolidine and of some Aliphatic Amines. *C. H. Richardson* and *H. H. Shepard*. (Jour. Agric. Res., 40, 11 (June 1, 1930), pp. 1007-1015.) [63.295.]
- The Fungicidal Properties of Certain Spray-Fluids. VII. *W. Goodwin*, *H. Martin* and *E. S. Salmon*. (Jour. Agric. Sci., xx, 3 (July, 1930), pp. 489-497.) [63.295.]
- The Defoliation of Gooseberries by Sulphur-containing Sprays. *H. Martin*. (Jour. S.E. Agric. Coll., Wye, No. 27 (1930), pp. 182-185.) [63.295; 63.41.]
- Control of Ragwort and other Weeds by Spraying. Remarkable Results with Sodium and Calcium Chlorate. *J. W. Deem*. (New Zealand Jour. Agric., xl, 5 (May 20, 1930), pp. 292-294.) [63.259; 63.295.]

Live Stock and Feeding

- Commercial Pig Production in Scotland. Lessons from the Scottish Bacon Pig Competitions. *Alex Calder*. (Trans. Highl. Agric. Soc. Scot., xlii, 1930, pp. 118-127.) [63.64; 63.752.]
- Potatoes in Stock Feeding. *J. K. Thompson*. (Trans. Highl. Agric. Soc. Scot., xlii, 1930, pp. 128-151.) [63.60432.]
- Potassium Iodide as a Mineral Supplement in Paired Feeding Experiments with Growing Swine. *W. E. Carroll*, et al. (Jour. Agric. Res., 41, 1 (July 1, 1930), pp. 65-77.) [612.394; 63.64; 043; 63.60432.]
- Feeding Pigs on Rough Rice. An Experiment at Hawkesbury Agricultural College. *F. Whitehouse* and *F. Bostock*. (Agric. Gaz. of New South Wales, xli, 7 (July 1, 1930), pp. 535-542.) [63.60432; 63.64; 043.]
- Influence of Small Quantities of Potassium Iodide on the Assimilation of Nitrogen, Phosphorus and Calcium in the Growing Pig. *F. J. McClure* and *H. H. Mitchell*. (Jour. Agric. Res., 41, 1 (July 1, 1930), pp. 79-87.) [612.394; 63.64; 043; 63.60432.]

- The Value of Grazing for Fattening Pigs. *H. R. Davidson*. (Scot. Jour. Agric., xiii, 3 (July, 1930), pp. 288-293.) [63.64 : 043.]
- Feeding the Bacon Pig. *C. Crowther*. (Jour. Yorks Agric. Soc., 1930, pp. 39-50.) [63.64 : 043.]
- Dried Sugar Beet Pulp: Its Value and Use. *J. K. Thompson*. (Jour. Yorks Agric. Soc., 1930, pp. 71-80.) [63.60432.]
- Jersey Cattle. *R. W. Bell*. (Jour. Yorks. Agric. Soc., 1930, pp. 81-87.) [63.62 ; 63.711.]
- Photography as a Help in the Examination of Cattle Foods. Part III.—The Examination of Leguminous Plants. Part IV.—Additional Notes on Some Oil Seeds. *W. L. Fielding* and *S. T. Parkinson*. (Jour. S.E. Agric. Coll., Wye, No. 27 (1930), pp. 45-73.) [63.6043 ; 63.60432.]
- Observations on "Blackface Sheep," their Origin and History. *A. E. Pease*. (Jour. Yorks. Agric. Soc., 1930, pp. 5-22.) [63.631.]
- The Economy of Washing Kent Sheep before Shearing. *N. L. Tinley*. (Jour. S.E. Agric. Coll., Wye, No. 27 (1930), pp. 205-208.) [63.631.]

Dairying

- Grades and Methods of Analysis of Dry Skim Milk. *E. C. Thompson*, *W. S. Slemmons* and *R. S. Fleming*. (Jour. Dairy Sci., xiii, 4 (July, 1930), pp. 319-335.) [63.712 ; 63.715.]
- The Length of Life of the Dairy Cow. *A. C. M'Candlish*. (Scot. Jour. Agric., xiii, 3 (July, 1930), pp. 284-287.) [63.711.]
- Optimum Amount of Silage in the Dairy Ration for Most Economical Production. *A. D. Pratt* and *G. C. White*. (Jour. Dairy Sci., xiii, 4 (July, 1930), pp. 291-307.) [63.60432 ; 63.711 : 043.]

Poultry

- Genetic Studies in Poultry. VIII.—On a Case of Sex-linkage within a Breed. *R. C. Punnett* and *M. S. Pease*. (Jour. Gen., xxii, 3 (July, 1930), pp. 395-397.) [575.1 ; 63.651.]
- The Value of Potassium Iodide as a Supplement to the Ration of Growing Chicks. *T. S. Hamilton* and *C. H. Kick*. (Jour. Agric. Res. 41, 2 (July 15, 1930), pp. 135-137.) [612.394 ; 63.60432 ; 63.651 : 043.]
- Feeding of Iodine to Poultry. Some Local Experiments and Results. *W. Simpson* and *R. Strand*. (New Zealand Jour. Agric., xl, 6 (June 20, 1930), pp. 403-406.) [612.394 ; 63.651 : 043.]

Veterinary Science

- "Grass-Disease." *S. H. Gaiger*. (Jour. Yorks. Agric. Soc., 1930, pp. 29-38.) [619.1.]
- An Atypical Case of Johne's Disease on the College Farm, Wye. *R. S. Roberts*. (Jour. S.E. Agric. Coll., Wye, No. 27 (1930), pp. 214-215.) [619.2.]
- The Warble Flies of Cattle. *R. Stewart MacDougall*. (Trans. Highl. Agric. Soc. Scot., xlii, 1930, pp. 75-112.) [619.2.]
- Significant Variables in the Blowfly Environment. *R. A. Wardle*. (Ann. App. Biol. xvii, 3 (Aug., 1930), pp. 554-574.) [59.169.]
- Black Disease (Infectious Necrotic Hepatitis) of Sheep in Australia. *A. W. Turner*. (Jour. Coun. Sci. Ind. Res. (Australia), iii, 2 (May, 1930), pp. 117-120.) [619.3.]

THE JOURNAL OF THE MINISTRY OF AGRICULTURE

Vol. XXXVII. No. 11.

FEBRUARY, 1931.

NOTES FOR THE MONTH

DEVELOPMENTS in the wheat markets of the world in recent weeks have turned attention particularly toward the World's Grain Exhibition and Conference which is to be held at Regina, Saskatchewan, in 1932. Original plans were largely for an exhibition of the chief food cereals, but existing conditions have turned the spot-light more particularly upon the Conference phase of the event. Experts in agricultural economics and agriculture from all parts of the world will be gathered together for a serious survey of conditions affecting grain production and of the best means of securing uninterrupted prosperity for those who are dependent upon that industry. The Exhibition, which is the largest of its kind ever planned, with prize money totalling more than £40,000, will still be a feature of great interest.

The Chairman of the National Committee is the Hon. Robert Weir, Minister of Agriculture in the Canadian Government, and each of the Canadian provinces has its provincial committee under the Chairmanship of the Provincial Minister of Agriculture. Representatives of these committees, along with a special committee on publicity, have recently completed their autumn conference.

Provision for the accommodation of the great numbers who are expected to attend the Conference in Regina in 1932 is receiving attention. It has been decided to ask the city of Regina to set aside fifty acres for a special camp that will be run on approved lines and will afford every facility for visitors. The co-operation of the Royal Canadian Mounted Police will be an important factor in this connexion. Standard charges will be authorized and the rates in hotels will be fixed.

A committee composed of technical experts is considering the many questions relative to the judging of the competitive

classes. There is a prospect that an international board of judges will be established. Not only will the judging be based upon the threshed cereals, but the cereals will be planted in test plots of land provided at the Dominion Government Experimental Farm at Indian Head, Saskatchewan, so that they may be judged while in the process of growing.

The co-operation of the Canadian Federal Department of Trade and Commerce has been secured, with the result that the services of Mr. J. O. Turcotte, Canadian Exhibition Commissioner, whose work at the World's Poultry Congress in London and at the Exhibition at Antwerp has received much favourable notice, will be in charge of the decorating and the staging of exhibits. It is expected that the number of exhibits will run to many thousands.

* * * * *

FOLLOWING the success of a three-day course for cowmen held in September last—a note of which appeared in the December issue of this JOURNAL—a course

**Short Course for
Poultrymen in
Hampshire**

of a similar length was arranged for men and women engaged in the poultry industry at the Farm Institute, Sparsholt, from December 31, 1930, to January 3,

1931.

Particulars of the course, including a syllabus and time table, were circulated to a number of poultry farmers in Hampshire early in December; no difficulty was experienced in obtaining entrants, and the number accepted was limited to 15, which was believed to be the maximum with whom the demonstrations could be effectively carried out.

The course was held in bad weather, and, from many points of view, at an inconvenient time of the year. It was, however, necessary that it should take place during the vacation, and desirable to choose a time that is comparatively slack on the average poultry farm in order that the employees might be spared to attend.

The following summary indicates the ground covered by the lectures and demonstrations which were given by members of the county staff with the assistance of officers of the Ministry:—

Lectures

Breeding, 8 hours.

Food Stuffs and Feeding, 3 hours.

Incubation and Rearing, 2 hours.

Fattening, 1 hour.

Housing and Layout of Plant, 1 hour.

Diseases and their control, 2 hours.

Demonstrations

Drawing and Trussing, 1 hour.

Methods of making a Post-Mortem Examination, 1 hour.

Culling and Selection by Handling, 3 hours.

Taking Blood for Agglutination Test and Vaccinating against Fowl Pox, 1 hour.

An equally valuable part of the course consisted of an hour's discussion each evening, during which a free interchange of ideas took place, on such problems as marketing, maturity and its relation to egg size, and other subjects, which lack of time prevented from being included in the syllabus.

All who attended were shown something of the activities in other departments of the Institute.

Three technical points of interest arose :—

(1) That more time could be profitably devoted to practice in the selection and culling of stock by handling.

(2) That there was a general desire for more information on diseases.

(3) That the economy of increased feeding in order to maintain high egg-production is not appreciated by many poultrymen, and should be further emphasized.

In the opinion of those who took it, the course was a great success and will be of considerable direct benefit to them in their work. There is, therefore, every encouragement to continue the series and arrange further courses for cowmen, poultrymen, and perhaps other skilled agricultural workers during future vacations, and every probability that the indirect effect of those already held will be to increase the demand for more. The period of three days appears to be short enough to allow of men being spared, and long enough for a good many ideas to be assimilated under such conditions as obtain at a Farm Institute.

* * * * *

WHEN he was an Assistant Secretary of this Department 26 years ago (1904), Dr. (now Sir William) Somerville expressed the following view : "I am by

Home-Grown**Feeding Stuff**

no means sure that it is in the best interests of agriculture that farmers should buy imported foods largely. In my opinion it is economically a much sounder policy to show farmers how they can grow larger and more nutritious crops at home. These demonstrations, aided by the Board, which show farmers how the crop on one half of a field can, *unaided by imported food*, produce more meat than the crop on the

other half given to animals *along with large quantities of cake*, are in my humble judgment more worthy of attention than fresh sources of cake and the like."

Since that time, research has confirmed the idea underlying Sir William Somerville's opinion. It is now recognized that in the past too much emphasis was laid upon protein-feeding (or cake-feeding) of animals on well-grazed pastures, and it is probably true that there is still in many cases an excessive use, and therefore waste, of protein in the feeding of stock at all times of the year. Judicious balancing of rations in accordance with the latest information gained by research may well lead to economies in the cost of production. The Ministry recently invited Dr. H. E. Woodman to prepare a Bulletin indicating how feeding stuffs produced on the farm may be most advantageously used in the feeding of stock for the production of meat, milk and wool. The Bulletin has now been issued, and may be obtained from the Ministry at the price of 8d. post free.

* * * * *

Of the home-grown apples and pears, sold in the markets at Christmas time, some were so perfect in quality, and of such pleasing appearance, that even the

**The Part of
Spraying in
High-grade Fruit
Production**

greatest critics of English fruit must have been surprised and almost satisfied. The small packages of rosy Cox's Orange Pippin apples, each carefully wrapped in a paper doily, and of juicy Doyenné du Comice pears embedded in their nests of wood wool, were as near perfection as can be. Such fine fruits indicate that, with energy and will, the British grower can excel in supplying the market with dessert fruit of a much higher standard of quality, and packed in a more attractive way, than can be brought from overseas. Such fruit, however, came from orchards where fruit growing is conducted on modern lines, and where the packing was done by people who have been prepared to forsake the accepted methods of the past and to use others that helped the fruit to make its appeal. These few men, by their example, are helping to establish in England the modern methods by which the production of this high-class market fruit is made possible.

These modern methods are not wrapped in mystery, but are simply the adaptation of science to fruit growing in the orchards, and the application of business methods in organization and in marketing.

Tree nutrition, fruit thinning and spraying all play their part, but it is more timely now to emphasize the last-named subject, since the importance of spraying cannot be stressed too strongly. Spraying is fundamental for the production of high-grade fruit; the only debatable point centres round the sprays to be used, and these will vary with climate.

In England the fruit plantations should be sprayed during the autumn and winter months with a reliable tar distillate wash (see article at p. 1078), either alone or combined with a mineral oil. This wash—the cleanser of trees and killer of insects' eggs—does so much in controlling insects and in improving the vitality of the trees that no fruit grower can afford not to use it. The tar-oil washes have little or no fungicidal action, and so cannot be expected to keep apples and pears free from scab, or plums from brown rot. For this reason, therefore, when the trees are nearing blossom time, and again when the petals have strewed the ground, the sprayers must be set at work forcing lime and sulphur or Bordeaux mixture on to the leaves to keep the fungus spores from gaining an entrance. Man's part is to keep the tree healthy, and there will follow the clean fruit that the market needs and for which good prices are paid.*

* * * * *

THE Ministry's Report on the prices and supplies of agricultural produce in 1929-30 has recently been published.

**Agricultural
Statistics, 1929
(Part II)**

In the opening part of the report, a general indication is given by means of index numbers of the changes that have taken place in recent years up to the late spring of 1930 in the price-level of agricultural produce as a whole, and of the alterations in prices of the different kinds of produce. In addition, the price changes which have occurred in live-stock farming are contrasted with those in arable farming, market gardening and fruit farming. References are also made to the more important

* Information on fruit growing, spraying of fruit trees, and insect and fungus pests of fruit will be found in the following publications which may be obtained from the Ministry at the prices named, post free:—

Fruit Production : Tree Fruits, 1s. 6d. net.

Fruit Production : Soft Fruits and Nuts, 1s. net.

Insect Pests of Fruit Trees, 10d. net.

Fungus Diseases of Fruit Trees, 8d. net.

Commercial Fruit Tree Spraying and What it Costs, 6d. net.

Every fruit grower should possess these publications and make the fullest use of them.

alterations in prices of feeding stuffs and fertilizers over the same period, to agricultural wages, prices of seeds, and to the progress recorded in 1929 in the administration of the Markets and Fairs (Weighing of Cattle) Acts, 1887 to 1926.

The remainder of the report is devoted, for the most part, to a consideration of the position as regards each of the more important individual commodities from the point of view of price changes, and of alterations in total imports and in the quantities received from the different sources, while the report concludes with a brief summary of the principal variations, in 1929, in the sources of imported supplies.

The usual statistical tables are appended showing average prices and imports in 1929 of a large number of agricultural products, with, in many cases, comparative figures for earlier years.

Copies of the Report, which forms Part II of the Agricultural Statistics, 1929, may be purchased through any bookseller or direct from H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2, price 1s. net or 1s. 2d. post free.

* * * * *

ACCORDING to returns made to the Ministry by the beet-sugar factories operating in Great Britain, the total quantity of home-grown beet-sugar manufactured during December, 1930, together with the quantity produced during the corresponding month in 1929, was :—

				cwt.
December, 1930	..	..	..	2,261,698
December, 1929	..	..	..	1,815,675

The total quantities of sugar produced during the two manufacturing campaigns to the end of December were :—

				cwt.
1930-31	..	..	..	6,990,578
1929-30	..	..	..	5,335,153

* * * * *

In recent years Johne's disease has been a matter of growing concern to the veterinary profession, and to farmers whose cattle have suffered from it. This

Johne's Disease in Cattle disease is a chronic, contagious enteritis that affects bovine animals. Although animals of other species—sheep, deer, goats and (rarely) horses—may be attacked, the disease is essentially one of cattle, and in its clinical form is seldom

observed in animals under 18 months of age. There is no reason to believe that any particular breed of cattle in Great Britain is more vulnerable to the disease than others are. Johne's disease is not transmissible to man, and both poultry and swine are naturally immune from it. The condition, which is also known as bacterial enteritis, or paratuberculosis, has been found to exist in many parts of the world. In order to provide information and guidance for those who may require it, the Ministry has just published a short, illustrated Bulletin on the subject, and copies may now be obtained at the price of 3d. net, post free.

No fewer than 127 students are receiving regular and organized instruction in agricultural subjects in Essex at the present time. Of these, 28 are enrolled for the correspondence course in Farm Book-keeping which is being conducted by the Economics Branch of the School of Agriculture at Cambridge. This course affords a training in the keeping of farm accounts and in the estimation of the contents of stacks, clamps, etc. There are, also, three organized day courses, arranged at different centres in the county, which are being attended by 36 sons of farmers. The remaining students are attending courses of instruction at the East Anglian Institute of Agriculture at Chelmsford. The Authority has also arranged a course of day classes for girls which began last month (January). The subjects dealt with in this course include horticulture, fruit preservation, dairying, poultry-keeping and beekeeping.

RETURNS have now been received from all the County Agricultural Committees in England and Wales showing the number of cases, dealt with under the provisions of the Corn Production Acts (Repeal) Act, 1921, for the destruction of weeds, during the year ended September 30, 1930. The figures for each year from 1922 to 1930 are summarized below, and include cases in London or County Borough areas for which no Agricultural Committee exists, and which were dealt with by the Ministry direct. Cases

settled satisfactorily by arrangement without reference to the Agricultural Committees are also included :—

	Year ended September 30									
	1922	1923	1924	1925	1926	1927	1928	1929	1930	
Total number of cases ..	269	1,010	1,530	1,514	2,409	2,927	3,593	4,331	5,452	
Dealt with by arrangement ..	187	919	1,426	1,323	2,125	2,709	3,356	4,095	5,150	
Notices served ..	82	91	104	191	284	218	237	236	302	
Prosecutions :—										
Successful ..	1	6	9	14	12	5	8	10	*6	
Unsuccessful ..	—	3	—	1	2	1	2	—	—	

* Five additional prosecutions pending.

A RESOLUTION expressing appreciation of the Ministry's action in regard to cherries imported from France, and suggesting that the prohibition date of importation from each zone should be further advanced, was passed at a meeting of the Horticultural Advisory Council, held on December 16, 1930. Another resolution recommended the continuance of the Importation of Raw Apples Order, under which low grade and unclassified apples are prohibited entry from the United States of America before the middle of November in each year. The Ministry was further urged to take immediate measures to prevent the importation from France of potatoes likely to introduce the Colorado Beetle into this country; also to proceed with a scheme for the application of the National Mark to jam made only from home-grown fresh fruit and sugar. Approval was expressed of the application, which may be made by the Horticultural Trades Association, for an Order-in-Council under the Merchandise Marks Act, 1926, for the marking of imported plants, trees and shrubs.



Photo. A. D. Middleton

British specimen of the grey squirrel

THE GREY SQUIRREL IN THE BRITISH ISLES

A. D. MIDDLETON,
University Museum, Oxford.

[The data on which this article is based constitute a part of the results of research on wild rodents carried on at Oxford with the aid of a grant from the Empire Marketing Board. The preliminary results of the investigation that is being made into the spread of the grey squirrel have been published in detail in the *Proceedings of the Zoological Society of London*, 1930, part 3, and readers desiring more complete information on the subject are advised to refer to this publication. The investigations on the grey squirrel are being continued, and the writer would welcome any further items of information.]

Description.—The American grey squirrel (*Sciurus carolinensis*) is a native rodent of the northern United States and southern Canada, where it is common in all the large deciduous forests, but does not extend its range far northwards into the coniferous belt. There are several varieties in America, but all those in the British Isles which have been examined by the writer conform to the description of the variety which inhabits north-eastern U.S.A. and south-eastern Canada.

Adult British specimens average about $1\frac{1}{2}$ pounds in weight ; the length of the body is about 12 inches, and the tail 9 inches. The general build of the animal is similar to that of the British red squirrel, but it is considerably larger. The colour effect is, at first sight, silver-grey, but there is a good deal of russet-brown coloration on all specimens ; the brown colour is usually prominent on the top of the head, the centre line of the back, and the upper surface of the feet and ankles, while a line of brown runs along the sides at the junction of the white abdominal coat with the grey flanks. The individual hairs show several colour zones of black, white and brown, which are especially noticeable in the long hairs of the tail. The eyes are prominent, and the ears rather small and without the tufts of hair which characterize the winter coat of the red squirrel. Pure white albino specimens are not uncommon, especially in the south-east of England.

Introduction and Spread in the British Isles.—The widespread distribution of the grey squirrel in this country at the time of writing (November, 1930) undoubtedly results from the introductions that have taken place since 1889, but there are records of grey squirrels existing in certain areas as early as



Map showing the range of the Grey Squirrel in the British Isles in 1930, with main centres of dispersal marked. (See page opposite.)

1828. Up to this time it has been ascertained that grey squirrels were liberated at 33 separate points in various parts of the country during the period 1889-1930; in many of these instances, however, they appear to have died out or to maintain a very precarious existence. The accompanying map shows the *main* centres of dispersal, and the approximate area

covered by 1930. In the accompanying table will be found details of each of the introductions marked on this map.

The squirrels introduced in the first instance were obtained direct from America, and several other stocks have since been brought over independently, but most of the secondary centres were established with squirrels from one or other of the centres previously formed. The Woburn centre, started in 1890, has been the principal source of grey squirrels obtained for liberation on private estates and in public parks and pleasure gardens. Although the folly of introducing these animals and forming new centres of dispersal is now becoming generally recognized, it will be seen that one such centre was started as recently as 1929.

INTRODUCTION POINTS OF GREY SQUIRRELS

No. on map	Locality	Date of introduction
1	Woburn Park, Bedfordshire	1890
2	Loch Long-side, Scotland	1892
3	Richmond, Surrey	1902
4	Rossett, Denbighshire	1903
5	Lyme Park, Cheshire	1903-4
6	Regent's Park, London	1905-7
7	Near Malton, Yorkshire	1906
8	Kew Gardens, London	1908
9	Farnham Royal, Buckinghamshire	1908-9
10	Dunham Park, Cheshire	1910
11	Frimley, Surrey	1910
12	Sandling, Kent	1910
13	Benenden, Kent	—
14	Bramhall, Cheshire	1911-12
15	Edgbaston, Birmingham	1912
16	Newtownforbes, Ireland	1913
17	Near Bedale, Yorkshire	1913
18	Nuneham-Sandford, Oxfordshire	—
19	Rougemont Gardens, Exeter, Devon	1915
20	Dunfermline, Scotland	1919
21	Bournemouth, Hampshire	—
22	Needwood Forest, Staffordshire	1929

Other introductions of doubtful importance :—

Bushey Park, Middlesex	1889
Stanwick, Northamptonshire	1918
Cliveden, Buckinghamshire	—
Bingley, West Yorkshire	1914
Environs of Edinburgh	—
Hebden Bridge, West Yorkshire	1921

It must be understood that the whole of the area marked on the map is not yet uniformly populated with grey squirrels, but represents the *range* of the animal by the autumn of 1930, and is based on a large number of reports from observers throughout the British Isles. The extension of range of the species is certainly not dependent on overcrowding in the

areas already populated, but appears to be the outcome of migratory instincts in individual squirrels, as isolated specimens or pairs frequently turn up suddenly as far as 20 miles from any previously populated locality. The border zones of the mapped areas are therefore generally very sparsely populated with grey squirrels at the present time; also, in the areas where the squirrel has been established for a long time, the distribution is by no means uniform, as they tend to congregate in some localities and leave others practically untouched. The population, calculated from numbers shot and seen in some of the most infested districts, has been found to reach as much as 3 per acre in favourable conditions. There is considerable evidence that the extension of range takes place rapidly along a river valley and is severely checked by hill country, especially moorland, such as the Cleveland Hills in Yorkshire.

The approximate distribution in each county concerned is given below in tabular form. From the progress already made, there seems little doubt that the grey squirrel will eventually populate the whole country, unless a successful means of extermination can be evolved, although the evidence available indicates that the mountainous country of North Wales, Cumberland and Northern Scotland will be less troubled by them than the lowland areas.

South-East England and the Midlands :

Kent : Practically the whole county.

Sussex : Nearly all except the south-eastern portion.

Surrey : The whole county.

Hampshire : The north-eastern half of the county.

Bournemouth : Gardens and environs of the town.

Middlesex : The whole county, where favourable.

Essex : Very few on extreme west of the county.

Hertfordshire : All except the north-eastern corner.

Cambridgeshire : The south-western borders.

Bedfordshire : The whole county.

Huntingdonshire : The southern part of the county.

Northamptonshire : All except the north-eastern portion.

Buckinghamshire : The whole county.

Oxfordshire : The whole county.

Berkshire : The whole county.

Wiltshire : Northern part, sparsely populated.

Gloucestershire : The north-eastern half of the county.

Warwickshire : Practically the whole county.

Worcestershire : Northern portion, sparsely populated.

Herefordshire : Few in north-eastern corner.

Shropshire : Few in south-eastern corner.

Staffordshire : Few in southern portion.

New centre (1929) in Needwood Forest.

Leicestershire : A few in the south of the county.

Devonshire : Environs of Exeter and northwards up Exe valley.

Nottinghamshire : Several recorded near Nottingham, but origin unknown.

Cheshire and North Wales area :

Cheshire : About three-quarters of the county in the north and east.

Denbighshire : The eastern quarter of the county.

Shropshire : The north-western borders.

Yorkshire area :

East Riding : North-western half of the Riding.

West Riding : North-eastern portion, and Wharfedale.

North Riding : Most of the eastern three-quarters, except the Cleveland Hills.

Durham : Few in the south ; west of Darlington.

Scotland :

Dumbartonshire : Practically the whole county.

Stirlingshire : Few in north-western portion.

Fife : A few miles radius round Dunfermline.

Edinburgh district : Several escapes from Zoo at Corstorphine.

Ireland :

County Longford : The district of Newtownforbes.

Habits, Food and Damage.—Grey squirrels appear to favour mixed deciduous woods, parklands, orchards and gardens, rather than the dense coniferous woods, which are the ideal habitat of the red squirrel. They spend a great deal of time on the ground, and are frequently seen in hedgerows and fields as much as half a mile from any wood or plantation. Few accurate data are yet available regarding their rate of reproduction, but such reliable evidence as there is indicates that an average of four young to the litter is usual, the maximum being six. One or two litters are raised in the breeding season. Although the evidence available is not yet conclusive, the young do not appear to breed in the year of their birth ; the length of life in normal conditions is not known, but probably varies from three to six years.

The food of the grey squirrel is as varied as its habitat—much less specialized than that of the native red squirrel. The following is a list of the different kinds of foods eaten ; the order of this list is relative to the amount of each class of food eaten, the most common foodstuffs being placed first and the occasional ones last :—

Green shoots and buds of various trees, coniferous and deciduous.

Nuts and seeds in all stages, ripe and unripe.

Fruits, wild and cultivated, ripe and unripe.

Inner bark of young trees, notably beech and sycamore.

Bulbs and roots of various kinds.

Birds eggs.

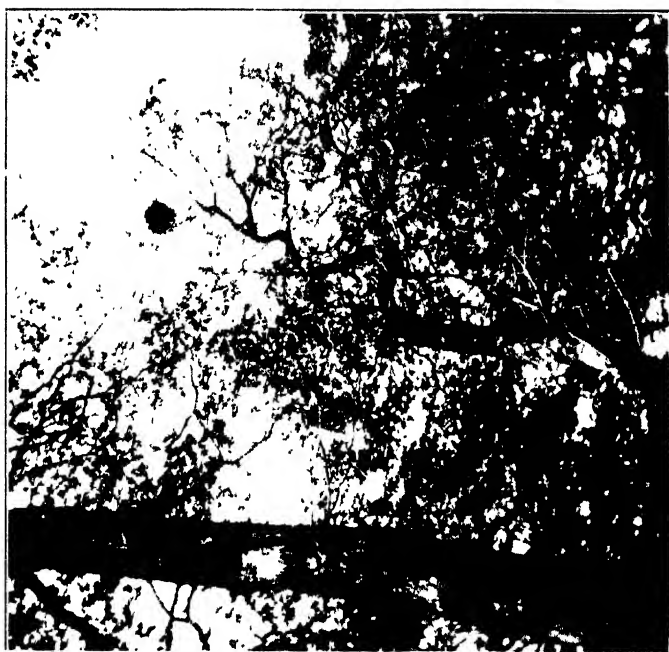
Young birds.

Carrión.

Each of these categories embraces numerous items, the eating of many of which is certainly destructive to marketable produce, and of economic importance. The destruction of

young shoots and buds of trees has serious effects upon the growth of the tree. As regards young forest trees, especially conifers, the leaders are frequently bitten off and a consequent distortion of the tree ensues, making the ultimate timber of little value. As for fruit-trees, the destruction of buds in the spring has a pronounced effect upon the yield of fruit. Practically every kind of fruit appears to be eaten with avidity, and the systematic collection and removal of all kinds of nuts in an unripe stage is a very widespread practice among grey squirrels. During the spring and early summer, a favourite food is the succulent inner bark of young trees, the sap-bearing layer being peeled completely off large patches, often girdling the tree, on trees of 10-20 years' growth. Beech and sycamore appear to be especially subjected to this form of damage, and thousands of young trees of these species have been killed by the squirrels. The bark of the Scots pine, a favourite food of the red squirrel, appears to be little touched by the grey species.

The destruction of birds' eggs by grey squirrels has caused a great deal of consternation, but, though there is no doubt that egg-eating is a frequent and serious offence, it cannot be so prevalent as many people believe. The grey squirrel would long ago have eliminated the entire resident bird population from many of its present strongholds had it been *particularly* addicted to nest-robbing: it is difficult to imagine any animal better suited to the practice of finding and robbing birds' nests. Nevertheless, there are many eye-witness accounts of grey squirrels eating eggs, and it is certain that such a food is very palatable to them. Taking all the evidence together, it appears that grey squirrels readily eat any eggs that they may find "accidentally" in the course of their normal wanderings: it matters not to the squirrel whether these are eggs of domestic fowls, game-birds, wood pigeons or sparrows. The same argument probably applies to the eating of young birds, of which there are many authentic records. The writer has no wish to under-emphasize the importance of this habit, but merely to state that eggs or young birds are an occasional, rather than a normal, item in the grey squirrel's diet. It is perhaps fortunate for the birds concerned that the nesting time coincides with a period of plenty in plant food for the squirrels, and thus the necessity of vigorous searching for food is obviated. One or two instances are recorded of young rabbits being killed and eaten in the nest, but there appears to be no ground for alarm on this point.



Photos A. D. Mathison
A nest (or den?) of the grey squirrel



A young sycamore tree from which large parts have been
peeled by grey squirrels

Red.

Grey.

Grey.

Red.

Comparative View of the English red with the grey squirrel.



Economic Effects.—Our experience of the depredations of the grey squirrel, during the latter part of its forty years' residence in this country, leaves little room for doubt that a uniform population throughout the British Isles would inevitably become a serious burden, both direct and indirect, and at the present rate of increase such a position will probably be reached in a very short time. Whereas the destructive habits of the red squirrel are more or less limited to certain aspects of forestry, those of the grey cause a considerable toll on forestry, agriculture, fruit growing and the bird life of the country. The growth of forestry in this country during the past ten years is leading to a remarkable change in the conditions of life for squirrels; within 50 years it is likely that there will be nearly a million acres of new forests, all of which are being raised as a strictly economic proposition. Such a state of affairs will be ideal for the support of a large squirrel population, but the business of forestry can ill afford the losses that it must suffer from such a pest. It is impossible to estimate the extent of the damage that may be caused by grey squirrels in young forests, as so much depends upon their preference for particular habitats and possible changes in their feeding habits in a changing environment, but it is certain that whenever squirrels feed in a young plantation they damage.

The exact effect of this additional rodent population on general agriculture is difficult to determine at the present stage, but, in any highly-cultivated area, no rodent can exist without doing appreciable damage to agricultural produce. In the past, squirrels have been of little or no consequence to agriculture, but this cannot be said of this new arrival with such a varied diet, considering the increasingly intensive nature of agriculture. In this respect the horticulturist becomes a particular object for the attention of grey squirrels. It has already been shown that the rapidly growing industry of fruit farming is especially liable to the depredations of these animals, and a high concentration in fruit-growing areas would certainly be a problem of considerable magnitude. Finally, the indirect results of the destruction of beneficial insectivorous birds by a grey squirrel population might become of serious significance to both forestry and all forms of agriculture.

On the other hand, it is possible that the fur of the British grey squirrel may be found of equal value to that of American and Continental origin, and the formation of a reasonable market for the pelts may give rise to a profitable new industry.

The flesh of the grey squirrel is well known to be very palatable and suitable for human consumption, but there is a curious and unfounded prejudice against its use for such a purpose. It is doubtful, however, if any benefits which may accrue from grey squirrels can ever weigh much against the enormous drain on the resources of the country that their presence is bound to entail.

Methods of Control.—The grey squirrel is not a difficult animal to keep within reasonable bounds if concerted action is taken against it, although its total extermination would be almost impossible by any means available at the moment. It is not so much the *manner* of killing it that needs emphasis as the *necessity* for killing it: if it continues to be tolerated, and even fostered, by a large number of people, as it certainly is at present, its increase can never be checked. The general attitude towards this animal will determine whether it is to be kept under efficient control, and there is ample evidence to prove that it should be treated as a dangerous pest.

Shooting and trapping are the only methods at present available of keeping down the numbers of this pest, since the poisoning of such an animal can rarely be carried out with safety; but it is hoped that future research into the question of specific diseases will do much to simplify the problem of controlling this and other rodents. By rigorous shooting at all seasons of the year a great deal can be done to check the increase; dogs can readily be trained to give valuable assistance in squirrel hunting, both by finding the animals and driving them into view of the gun—a most important point, as otherwise these squirrels are extremely adept at keeping the trunk of a tree between themselves and a charge of shot. A most satisfactory method is for two guns and a dog to work together, as the squirrels, when “marked” by the dog, are then invariably within reach of one of the guns. A .410 shot gun or .22 sporting rifle serves admirably for squirrel shooting, and the latter provides an additional element of sport. A powerful air-rifle is also quite efficient for the purpose, and is especially suitable for the private owner of a small estate or garden who does not care for noise and the trouble of gun licences or permits.

Many keepers make a practice of putting a charge of shot into any new squirrel nests seen in the spring, and this is to be recommended to farmers and keepers generally as a frequently successful mode of attack in the course of an

ordinary tour of inspection on a farm or estate. Particular attention should be paid to the killing of the first grey squirrels seen in a district, for, as already explained, isolated pairs frequently trek over considerable distances, and if allowed to settle down and breed will soon be the source of a new infestation, while, by timely shooting, such an event may be forestalled for many years. It is well worth while spending a whole day hunting down the first pair of grey squirrels that appear in a particular district.

The formation of squirrel clubs, or general vermin clubs, among landowners and farmers is strongly recommended as giving an incentive for keeping down the number of grey squirrels. The Highland Squirrel Club, which has been in active existence for nearly 30 years in the north of Scotland for the purpose of killing red squirrels, is an excellent example of this type of club, and has so far accounted for over 80,000 squirrels. Members pay an annual subscription varying according to the acreage of their estates, and the funds are used for paying a "tally" of from 3*d.* to 6*d.* a tail for all squirrels shot on members' estates. By such a system, some members who rigorously shoot down their squirrels actually receive considerably more in "tally money" than they pay in subscriptions. County grey squirrel clubs on these lines could readily be organized by agricultural and arboricultural societies, or branches of the National Farmers' Union, and the writer would be pleased to offer detailed suggestions and advice on the formation of any such clubs that may be contemplated.

Trapping, except in particular instances, is not usually favoured by farmers, but gamekeepers will readily apply this method of keeping down grey squirrels, and there is little need to offer them any advice on the subject. It has been found by many keepers that these squirrels are easily attracted to flesh and egg baits by exactly the same procedure as is adopted for stoats, and in this respect the tunnel trap has been proved to be very efficient. It should, however, be noted that the use of spring traps, except in rabbit holes or similar situations, is prohibited by the Ground Game Act, 1880, and that, having regard to the Wild Birds Protection Act, 1904, the fixing, placing or setting of any traps or similar instrument on any pole, tree or cairn of stones or earth, for the purpose of catching grey squirrels is not permissible as the law stands at present. A very useful trap where the squirrels are numerous is a wire-netting cage, two or three feet square, with a "sleeve"

entrance either at the top or side, corn being used as a bait ; such a trap has the advantage of remaining set for an indefinite period, and any other animals or birds which are caught accidentally can readily be released.

In conclusion, the importance of adopting a definitely inimical attitude towards grey squirrels cannot be over-emphasized, for there is every reason to believe that these aliens will quickly become an unmitigated pest of a hitherto unknown character throughout the country, unless determined action is taken against them by all concerned.

WINTER SPRAYING FOR THE CONTROL OF THE APPLE CAPSID BUG

F. R. PETHERBRIDGE, M.A., and G. L. HEY, B.A.,
School of Agriculture, Cambridge.

STANILAND and Walton have shown that the Long Ashton tar-distillate wash, applied at a 10 per cent. concentration during the dormant season, is capable of effecting a marked reduction of the Apple Capsid Bug (*Plesiocoris rugicollis*) on some varieties of apples in certain districts. The experiments here described were undertaken with the object of discovering an effective means of preventing the hatching of the eggs of this pest in the Eastern counties.

Experiment No. 1.—This was carried out, in 1929, at Friday Bridge, near Wisbech, in collaboration with Mr. W. G. Kent, Horticultural Superintendent for the Isle of Ely. As the ordinary Long Ashton wash is not suitable for use with the hard, dyke waters of the district, a modified Long Ashton wash (one solution) was used in this instance. The excessive hardness of the dyke water made it necessary to add size to the ordinary tar-distillate wash* to secure a satisfactory emulsion. Each plot consisted of about 20 trees of the Bramley's Seedling and Grenadier varieties, 14 years old.

The plots were separated from each other by two rows of Grenadiers. The spraying took place on March 6 and 7, the spray being applied by means of a 1½ h.p. petrol pump supplying two nozzles. On June 6, a count was made of the

* Tar-distillate wash, or ordinary tar-distillate wash, is the name given to a number of proprietary washes made from tar-distillates without removal of the tar acids. Such washes have been used in this country for several years.

number of marked shoots on the lower half of the Grenadier trees, the results being recorded in Table I.

TABLE I.—FRIDAY BRIDGE (GRENADIERS)

Plot	Average No. marked shoots per tree
3 Control	245
4 Mineral oil emulsion B, 7 per cent. ..	45
5 Modified Long Ashton wash, 12 per cent. ..	70
2 " " " " 10 " ..	73
6 Tar-distillate wash, 12 per cent. ..	158
1 " " 10 " ..	196

As a result of severe frost injury, the crop was a poor one, and the apples, although graded, were not sufficiently numerous to give reliable results. The mineral oil emulsion used gave the best control of the Apple Capsid, but failed to control the Rosy Apple Aphis (*Anuraphis roseus*), although the attack of the latter pest was only slight on the control trees. It was, however, readily controlled by the other washes.

Experiment No. 2.—A similar experiment was carried out, in 1929, at Burwell, Cambridgeshire, in collaboration with Mr. A. T. Paskett, the County Horticultural Adviser. Here, each plot consisted of 12 trees of the Grenadier variety. The spraying, which took place on March 8, was effected by a headland pump, giving a pressure of about 80 lb. per sq. in., and supplying two nozzles. On June 4, a count was made of the number of shoots attacked by the Apple Capsid Bug on the lower parts of the trees. The result is given in Table II.

TABLE II.—BURWELL, CAMBRIDGESHIRE (GRENADIERS)

Row	Average No. marked shoots per tree
5 Control	114
8 Mineral oil emulsion B, 7 per cent. ..	14
4 Modified Long Ashton wash, 12 per cent. ..	18
7 Tar-distillate wash, 10 per cent. ..	24
3 " " 12 " ..	26
6 Modified Long Ashton wash, 10 per cent. ..	79

As a result of severe frost, there were not sufficient apples to give reliable results. The mineral oil emulsion again gave the best control, but this was the first occasion on which the writers had seen such a large reduction of capsids effected with an ordinary tar-distillate wash.

The results obtained in the above two experiments, taken together with those obtained by Staniland and Walton, using Long Ashton wash and modified Long Ashton wash, suggested that the trials might be continued another year and that they might include mixtures of the mineral oil emulsions with the Long Ashton wash or modified Long Ashton wash.

Experiment No. 3.—This was carried out, in 1930, at Bluntisham, Huntingdonshire, in collaboration with Mr. F. Tunnington, the County Horticultural Organizer. Each plot consisted of about 10 trees of the Bramley's Seedling variety. Spraying was carried out, on February 18, by means of a horse-drawn, barrow-type hand-pump, giving a pressure of about 80 lb. per sq. in., and supplying two nozzles. The temperature was low, there being ice on the top of the dyke water from which a supply was drawn. About 4 gal. of wash were used on each tree. For the mixed washes, the tar-distillate containing an emulsifier was poured into the water, caustic soda being subsequently added and the mixture emulsified by thorough stirring; the mineral oil emulsion was then added. On July 18, a count was made of the total number of apples on each tree, and the percentage marked by the Apple Capsid Bug was determined. The results are given in Table III.

TABLE III.—BLUNTISHAM, HUNTS (BRAMLEY'S SEEDLING)

<i>Treatment</i>	<i>Average total No. of apples per tree</i>	<i>Percentage of marked apples</i>
Control (one plot and two half-plots) . .	22	52.8
Mineral oil emulsion B, $7\frac{1}{2}$ per cent., plus L. Ashton, $7\frac{1}{2}$ per cent. . .	55	2.0
Mineral oil emulsion A, $7\frac{1}{2}$ per cent., plus L. Ashton, $7\frac{1}{2}$ per cent. . .	64	2.3
Long Ashton, $12\frac{1}{2}$ per cent.	113	7.0
Mineral oil emulsion A, $7\frac{1}{2}$ per cent. . .	105	7.1
Long Ashton, 10 per cent.	139	14.6

On October 6, the apples on these trees were picked, graded and weighed, results being as shown in Table IV.

TABLE IV.—BLUNTISHAM (BRAMLEY'S SEEDLING)

<i>Treatment</i>	<i>Av. weight of apples per tree lb.</i>	<i>Percentage weight of apples</i>		
		<i>Badly marked</i>	<i>Slightly marked</i>	<i>Clean</i>
Control	9	47.6	14.5	37.9
Mineral oil emulsion B, $7\frac{1}{2}$ per cent., plus L.A., $7\frac{1}{2}$ per cent.	18 $\frac{1}{2}$	0.9	1.2	97.9
Mineral oil emulsion A, $7\frac{1}{2}$ per cent., plus L.A., $7\frac{1}{2}$ per cent.	30	2.3	1.7	96.0
Long Ashton, $12\frac{1}{2}$ per cent.	38	6.6	2.0	91.4
Mineral oil emulsion A, $7\frac{1}{2}$ per cent.	46	10.3	3.4	86.3
Long Ashton, 10 per cent.	46	23.4	2.6	74.0

It will be seen, from Tables III and IV, that the mixture of the Long Ashton wash and either of the mineral oil emulsions used gave a very good control of the Apple Capsid Bug; that Long Ashton wash at $12\frac{1}{2}$ per cent. gave a good control; that mineral oil emulsion A, alone, at a concentration of $7\frac{1}{2}$ per

cent., gave a fairly good control; but that only a moderate control was given by Long Ashton wash when used at a concentration of 10 per cent. Considerable differences in the yields of the plots will also be noticed. Although the number of trees is not sufficient to give critical results, some reasons may be offered for these variations.

The very low yield of the control plots is attributable chiefly to attacks of Winter Moth caterpillars assisted by the Apple Capsid Bug. All the sprays used gave a good control of caterpillars, and the foliage growth was very good. The reduction in the yield of the plots, sprayed with a mixture of Long Ashton wash and a mineral oil emulsion, was caused by the killing of a number of the fruit buds. This mixture also retarded the opening of the blossoms; at blossoming time the trees appeared to be suffering badly from spray damage. Long Ashton wash, at a concentration of $12\frac{1}{2}$ per cent., also retarded the opening of the blossom buds, but killed very few of them. Long Ashton wash, at a concentration of 10 per cent., retarded the opening of the fruit buds, but no damage was noticed on this particular plot. Mineral oil emulsion A, at a concentration of $7\frac{1}{2}$ per cent., caused no damage to the fruit and no retardation.

Summer Spraying.—To compare the value of winter with summer spraying, two of the neighbouring plots at Bluntisham were sprayed, on May 15, 1930, with soft soap and nicotine and with a pyrethrum wash, respectively. The results of counts, made on July 18, are detailed in Tables V and VI.

TABLE V.—BLUNTISHAM, HUNTS. SUMMER SPRAYING (BRAMLEY'S SEEDLING)

<i>Treatment</i>	<i>Average No. of apples per tree</i>	<i>Percentage of marked apples</i>
Control (one plot and two half-plots)	22	52.8
Soft soap, 5 lb., plus nicotine (95.98 per cent.), 4 oz., water, 40 gall. . .	57	6.4
* Pyrethrum A, 1 part in 80 parts of water	54	7.6

TABLE VI.—BLUNTISHAM, HUNTS, SUMMER SPRAYING (BRAMLEY'S SEEDLING)

<i>Treatment</i>	<i>Average weight of apples per tree lb.</i>	<i>Percentage weight of apples</i>		
		<i>Badly marked</i>	<i>Slightly marked</i>	<i>Clean</i>
Control	9	47.6	14.5	37.9
Soft soap, 5 lb., nicotine (95.98 per cent.), 4 oz., water, 40 gall. . .	14	3.4	7.6	89.0
Pyrethrum A, 1 part in 80 parts of water .. .	16	4.2	5.8	90.0

* A proprietary wash containing pyrethrum. This dilution is the equivalent of 1 per cent. of pyrethrum flowers.

From these figures, it will be seen that soft soap and nicotine gave as good a control of the Apple Capsid Bug as did the Long Ashton wash at 12½ per cent., and that the pyrethrum wash gave a similar result. The low yields shown in Table VI were due to caterpillar attack.

Experiment No. 4.—This was carried out, in 1930, at Wisbech St. Mary, in collaboration with Mr. W. G. Kent, Horticultural Superintendent for the Isle of Ely. As the dyke waters of the district are very hard, rainwater was used for making the Long Ashton wash, but dyke water was used for the other washes. The trees (variety, Lord Derby) were 16 years old and planted 24 ft. by 12 ft. The experimental area consisted of 54 rows of 4 trees each, and each plot consisted of 8 trees. Some of the plots were sprayed early and some late, the object being to discover whether the date of spraying has any important bearing on the results. The early spraying took place on January 27 and 28, and the late spraying on March 3. On both occasions, a headland hand-pump, supplying two nozzles, was used.

On September 19, 20 and 21, the apples were picked and graded into four divisions :—

- (1) Clean.
- (2) With slight Capsid markings (most of these apples were sent to market).
- (3) With moderate Capsid markings (these were not suitable for sending to market).
- (4) With bad Capsid markings.

The results are set out in detail in Table VII.

In Table VII, considerable variation in the yields of the various plots will be noticed. This was attributable in large measure to caterpillar attacks, the chief culprit being Winter Moth. The control plots were badly attacked. The plots on which mineral oil emulsion was used, at a concentration of 7½ per cent., also suffered moderately badly. At a concentration of 10 per cent. there was very little caterpillar attack and practically no reduction in yield from this cause. The mixture of modified Long Ashton wash and mineral oil emulsion, applied late, gave the best control of the Apple Capsid Bug, but killed a number of fruit buds and, consequently, reduced the crop.

In connexion with the damage to the apple fruit buds, it must be remembered that the winter of 1929-30 was an exceptionally mild one, and this may have had some influence on the amount of damage done.

TABLE VII.—WISBECH (VARIETY, LORD DERBY), 1930

Notes.—Early spraying, January 27 and 28: late spraying, March 3.
L.A.—Long Ashton Wash. L.A.M.—Modified Long Ashton Wash.

<i>Spray</i>	<i>No. of plots</i>	<i>Weight of apples per tree lb.</i>	<i>Percentage weight of apples</i>			
			<i>Bad mark- ings</i>	<i>Mod- erate mark- ings</i>	<i>Slight mark- ings</i>	<i>Clean</i>
Min. oil emulsion A, 7½ per cent., plus L.A.M., 7½ per cent. Late ..	1	89½	7.2	8.1	17.9	66.8
Min. oil emulsion B, 7½ per cent., plus L.A.M., 7½ per cent. Late ..	2	74	9.1	8.5	24.0	58.4
Min. oil emulsion B, 10 per cent. Late ..	1	98½	13.4	14.7	21.6	50.2
Min. oil emulsion B, 5 per cent., plus L.A.M., 5 per cent. Late ..	1	86½	7.2	19.8	23.0	50.0
Min. oil emulsion A, 7½ per cent., plus L.A.M., 7 per cent. Early ..	2	105½	12.0	14.5	25.5	48.0
Min. oil emulsion A, 7½ per cent. Late ..	1	98	10.1	18.4	35.5	36.0
L.A.M., 12½ per cent. Early	2	116½	20.6	21.0	25.0	33.3
Min. oil emulsion B, 10 per cent. Early ..	1	100	9.6	25.2	37.0	28.2
L.A., 10 per cent. Late ..	1	113½	33.8	19.1	22.2	24.9
L.A.M., 12½ per cent. Late	2	94½	29.9	24.1	21.1	24.9
L.A., 10 per cent. Early ..	2	120	30.8	30.2	16.4	22.6
L.A.M., 15 per cent. Early	2	102	37.7	20.2	20.0	22.1
Min. oil emulsion B, 7½ per cent. Late ..	1	66½	28.8	35.8	18.0	17.4
Min. oil emulsion A, 7½ per cent., plus L.A., 7½ per cent. Early ..	1	112½	35.4	20.8	26.4	17.4
L.A., 12½ per cent. Early ..	2	95	32.2	38.8	17.1	11.9
Min. oil emulsion A, 7½ per cent. Early ..	1	54	74.3	13.9	8.1	3.7
Control ..	4	19	67.9	19.8	7.0	5.2

Table VII indicates that neither the Long Ashton wash nor the modified Long Ashton wash used gave a satisfactory control of the Apple Capsid Bug. The best result was obtained with a Long Ashton modified 12½ per cent. solution, but it produced only 33 per cent. of clean apples. The Long Ashton wash at 12½ per cent. gave only 12 per cent. of clean apples, a result the writers are unable to account for in any way. Mineral oil emulsion B, applied at a concentration of 10 per cent., gave moderately good results; but these emulsions, at a concentration of 7½ per cent., gave disappointing results, with the exception of mineral oil emulsion A, applied late. The best control of the Apple Capsid Bug was given by a mixture of the Long Ashton modified wash with a mineral oil emulsion wash, both at a concentration of 7½ per cent., applied late. One of the early mixtures gave very poor results.

Time of Spraying.—In Experiment No. 4, an attempt was made to decide whether early or late application of the washes was an important factor. In two instances, the duplicate plots gave a wide variation, showing that the experimental error in this trial was very high; consequently, it is not safe to draw definite conclusions. When mineral oil emulsions are employed, the time of application seems to have an important bearing on the results obtained. The late application (March 3) of both emulsions A and B gave a much better control of the Apple Capsid Bug than the early spraying on January 27. With the Long Ashton wash, the time of application made no significant difference in the results obtained; nor do the figures give any indication whether it is better to apply the Long Ashton modified wash late or early. With both mixtures of the modified Long Ashton wash and mineral oil emulsions, the late application (March 3) gave a much better control of the Apple Capsid Bug than the early one (January 27).

The figures suggest that better results are likely to be obtained with mineral oil emulsions, and mixtures containing mineral oil emulsions, if these are applied as late as possible. A number of growers in the Wisbech district have formed the opinion that late spraying gives them better results than early spraying with Long Ashton or modified Long Ashton washes.

Varietal Differences.—Good results were obtained in the foregoing trials with mineral oil emulsions, Long Ashton wash and modified Long Ashton wash when the variety of apples sprayed was either Bramley's Seedling or Grenadier. In Experiment No. 4, where the variety was Lord Derby, these washes gave disappointing results. In this connexion it is interesting to note that, in the experiments conducted by Staniland and Walton, in 1929,* the Long Ashton wash also gave a poor control of the Apple Capsid Bug on the variety Lord Derby. This wash, at 10 per cent. concentration, was applied (March 9) on Lord Derby apples at one centre only (Wilmington, Kent). Poor control was also given on this variety by the modified Long Ashton wash at 10 per cent. when applied (March 8 and 9) at two centres in Kent. Yet at one of the centres (Crockenhill) 10 per cent. modified Long Ashton wash, applied to Bismarcks on March 9, gave a good control of the Apple Capsid Bug.

* *Vide* Annual Report of the Long Ashton Research Station, 1929.

In some experiments, carried out by Col. M. C. Clayton in his orchard at West Walton, near Wisbech, in 1930, and visited periodically by the writers, a good control of the Apple Capsid Bug on the variety Lord Derby was obtained by spraying, during the third week in March, with a 10 per cent. Long Ashton wash. At the same time, a fairly good control resulted from the use of a 10 per cent. modified Long Ashton wash. With both washes, however, better results were obtained on Bramley's Seedling.

These results suggest that control of the Apple Capsid Bug by winter spraying is less effective in the case of the Lord Derby variety than with other varieties, such as Bramley's Seedling. The position of the eggs and the structure of the shoots do not suggest any explanation for the varying results.

There would appear to be a marked difference, also, in the susceptibility of varieties to fruit-bud injury; Bramley's Seedling buds, for example, suffered injury in orchards where those of Lord Derby were unaffected, although both were sprayed on the same day and with the same wash.

Control Measures.—From the above results, from those of other workers, and from observations made in a number of orchards, it is difficult to determine which is the most economical method of reducing Apple Capsid Bug by winter spraying. There appear to be five possible methods:—

1.—*Spraying with Long Ashton Wash at a Concentration of 10 per cent.*—This has given good results in some orchards, but not in others. In 1930, gooseberries and strawberries, growing under trees sprayed with this wash, were seriously injured. Consequently, it is dangerous to use it where trees are under-cropped with the fruits named. In some cases, this wash retarded the opening of the apple blossom buds and a few were killed by it. It must be remembered that this wash is made by a number of different firms, and there appears to be a marked variation in the products placed on the market under the name of "Long Ashton Wash." *It is important, therefore, that the wash should be made according to the Long Ashton specification.*

2. *Spraying with modified Long Ashton Wash at a Concentration of 12½ per cent.*—This should be used only where the available water is too hard for making the Long Ashton wash, or until such time as a modified wash is obtainable which gives as good results as the Long Ashton wash. There are a number of modified Long Ashton washes on the market;

some appear to give better results than others, but even the best have given poor results in a number of orchards. In 1930, some of them seriously damaged gooseberries and strawberries growing beneath trees that were sprayed, and some of them killed a number of blossom buds, especially on the variety Bramley's Seedling, whereas other modified Long Ashton washes caused no injury to Bramley's Seedling in the same orchard.

3. *Spraying with Mineral Oil Emulsion at a Concentration of 7½ per cent., or rather higher.*—The power of these proprietary washes to prevent Apple Capsid eggs from hatching varies considerably. Some of them, at a concentration of 7½ per cent., have given rather better results than Long Ashton washes at a concentration of 10 per cent., although the results on Lord Derbys have been very variable. Very little damage to apple trees or undercrops has resulted from the use of these washes. Their great drawback is failure to control attacks of aphides; and they do not give such a good control of caterpillar as the previous washes. In several instances, however, they have given a good control of Red Spider (*Oligonychus ulmi*). Late applications of these washes have given the best control of the Apple Capsid Bug. Where Winter Moth is likely to cause loss of crop, trees that have been sprayed with a mineral oil emulsion only should be banded to prevent the females from laying eggs.

4. *Spraying with a Mixture of Mineral Oil Emulsion and Long Ashton Wash (or modified Long Ashton Wash or ordinary Tar-distillate Wash*).*—These mixtures have given the best control of the Apple Capsid Bug at concentrations, however, that caused the most injury to the apple fruit buds and to undercrops such as gooseberries and strawberries. Late applications have given the best control.

Staniland and Walton† gave the composition of a mixture of this kind that controls both the Apple Capsid Bug (*Plesio-coris rugicollis*) and the Common Green Capsid Bug (*Lygus pabulinus*) on black currants without causing injury. A mixture of this kind, containing sufficient tar-distillate to control aphides and sufficient mineral oils to give a big reduction of Capsids and Red Spider, appears to be the most promising as a general winter wash for the control of insects on apple

* In cases where the two emulsions will mix satisfactorily.

† This JOURNAL, August, 1930, p. 476.

trees on which the Apple Capsid Bug is present. It will probably be difficult to find a mixture of this kind that will not injure gooseberries and strawberries growing beneath.

5. *Spraying first with an ordinary Tar-distillate Wash at a Concentration of 5 or 6 per cent., and again, before the Buds begin to swell, with a Mineral Oil Emulsion at a Concentration of 7½ or 8 per cent.*—Ordinary tar-distillate wash is suggested as being cheaper than the Long Ashton wash or modified Long Ashton washes, which would answer the same purpose as the ordinary tar-distillate wash for the control of the Rosy Apple Aphis. Some growers tried this in 1930, in the Wisbech district, with success. It has the disadvantage of being more expensive than the previous methods. In a mixed orchard of apples and plums, however, it suggests itself as being the best method for controlling the Apple Capsid Bug and Rosy Apple Aphis without causing serious injury to the plums. The plums would be sprayed with the tar-distillate wash to control Leaf-Curling Plum Aphis, but not with the mineral oil emulsion.

ANIMAL PIGMENTS

Sir J. ARTHUR THOMSON, M.A., LL.D.,

*Emeritus Professor of Natural History in the University of
Aberdeen.*

What Colour Means.—We live in a world rich in colour—of sea and sky, of mountains and precious stones, and, finest of all, of plants and animals. The colours are our sensations, due to what particular wave-lengths of light reach our retina, and thence excite our brain. When all the ordinary light-rays of different wave-lengths reach our eye, we see the common light of day or, it may be, a white object ; but if only a *fraction* of the ordinary light reaches us, we see some colour or other according to the fraction. At the one end of the spectrum, familiar in the rainbow, there are the violet rays with shortest wave-length, some forty millionths of a centimetre long ; at the other end are the red rays with longest wave-length, twice as long as the violet. According to the wave-length is the colour-sensation ; and it is worth remembering that ants, as Sir John Lubbock first showed, can see the ultra-violet rays which are invisible to us, though happily we are not insensitive to their healthful influence. If we call visible light an octave, there are 61 other measured octaves of electro-magnetic vibrations, from the very short-waved rays used in radio-therapy to the very long ones used in broadcasting ; and while different notes, so to speak, of the visible light octave call forth different colour-sensations, a blend of all the notes, as from snow, foam, clouds, and the like, produces the sensation of *whiteness*, for there is complete reflection of the whole light from the mirroring surfaces of crystals or bubbles as the case may be. When the light comes to our eye after passing through a coloured body or fluid, or after being reflected from a coloured surface, then it has been to some extent filtered or tampered with. Whenever that is the case, we see *colour*, which varies according to the nature of the filtering. Thus if the rays of longest wave-length (red) have been absorbed or in any way subtracted, then the object will appear green—the colour “complementary” to that which was filtered out. If “blue” is filtered out the object will appear “orange.” We must not dwell on this physical aspect ; the point is that “colour” is due to some interference with the wholeness of white light.

Three Kinds of Coloration.—Among plants and animals there are many substances, called *pigments*, the molecular structure of which is such that they interfere with the wholeness

of the light that passes through them or is reflected from them. In a rough way, they might be compared with paints, but this is a case where a simple comparison is not a very useful one, especially when we come to face certain peculiar "pigments" which have little or no colour! That a pigment may be colourless is a statement to disbelieve until one understands it.

As examples of organic pigments we may mention the two most important, chlorophyll in plants and hæmoglobin in animals, which are very different from one another, though with a good deal in common. The chlorophyll-pigments, for they are in the plural, absorb some of the orange-yellow-red rays, and use this energy to build up carbon dioxide and water into sugar and the like—the most fundamental vital process in the world. The red-blood-pigment or hæmoglobin of all higher animals owes its great importance to its power of capturing oxygen, *e.g.*, in the lining of the lungs, and of readily surrendering it again to the living matter of the body. The melanins of dark-coloured birds and beasts, *e.g.*, crow and Black Angus, are familiar examples of pigments; and everyone knows, though not by name, the reddish pigment (zoonerythrin) of shrimps and prawns, which is bluish in the lobster until it is boiled. First of all, then, the colour of an animal may be due to particular organic substances or pigments, whose structure is such that it somehow interferes with the wholeness of the white light that falls upon it.

In the second place, there may be brilliant colours without any pigment at all, as is plain enough from the iridescent soap-bubble. The bubble has all the colours of the rainbow, but it is only a transparent film of soap and water. Everyone knows the beautiful colours of mother-of-pearl; but if the shell is pounded, it is only white chalk. The colouring in this and other cases is due to the way in which the light is reflected, from a film in the soap-bubble, from a finely layered or laminated texture in the pearl-oyster's shell, or from a delicate surface graining or cross-hatching in many other cases.

In the third place, the colouring of the animal may be due to a combination of pigmentary and structural (or physical) coloration; and this gives the finest display of all. We are familiar with it in the peacock's tail-feathers (really the "tail-coverts") and in many brilliant butterflies. There is an underlying pigment, the effect of which on the light that falls on the body is enhanced by the fine structure of the surface. In many cases the pigment is a simple brown, but the external sculpturing makes it like a living jewel. Often there may

result a bright colour, such as blue, which is not hinted at in the pigment. A bruising of the texture spoils the fineness of the colouring, and another feature is that the colour changes a little as the animal moves, or as we move, for different parts of the rainbow colouring reach our eye. This is familiar in many birds, with so-called "metallic" glimmer in their plumage. To sum up, coloration may be (1) pigmentary, as in the ruddy animal or the green plant; (2) structural, as in mother-of-pearl; and (3) a combination of the two, as in peacock's feathers.

Blood Pigments.—For several reasons we give the first place to the blood-pigments, such as the hæmoglobin of all the higher animals. The increase of vigour as we ascend the scale of life is partly due to the abundance of hæmoglobin and the use that is made of it, because, as we have said, it has the power of readily entering into a loose union with oxygen, captured in various ways, *e.g.*, on the internal surface of lungs, or on the external surface of gills. Man has some twenty-five billions of red-blood-corpuscles, which, if spread out, would cover a surface of over 3,000 square yards! Thus, taken together, the red-blood-corpuscles represent a very extensive internal surface for oxygen-capture. The mere possession of hæmoglobin, however, does not mean a high status in the scale of being, for the earthworm's hæmoglobin is much the same as ours. As far as we know, the first animals to produce or, so to speak, invent hæmoglobin were certain marine worms, known as ribbon-worms or nemertines; and this was one of the momentous steps in Organic Evolution. It opened the portal to higher life. Yet it must be noticed that among backboneless animals there are some other blood-pigments, similar to hæmoglobin, but not so effective. Thus hæmocyanin is common among crustaceans and molluscs.

Hæmoglobin has a very complex chemical composition, with a large molecule. It may be split into two parts, (1) colourless protein called *globin*, which varies greatly from one type to another, and (2) a constant coloured portion called *hæm*. This consists of four pyrrol rings linked together by an atom of iron—a pyrrol ring being C-C-C-C-N, four atoms of carbon united with one of nitrogen. There is a remarkable reason for mentioning this point, even in an elementary article, for the same pyrrol ring occurs in chlorophyll, the characteristic green pigment of plants.

There is a continual breaking down of hæmoglobin in the body, and some of the products almost certainly give rise to the

pigments of the bile in backboneed animals, such as the green biliverdin. Other disintegration products of hæmoglobin or some related blood-pigment are deposited in the tissues of various backboneless animals, such as leeches and molluscs. It may be mentioned that the faintly bluish blood-pigment, called hæmocyanin, that is common in crustaceans and molluscs, has copper where hæmoglobin has iron.

Also related, because containing "hæm," are certain pigments called cytochromes (cell-pigments), that were discovered by Keilin in 1925, and are very widely distributed in plants as well as in animals. They seem to be concerned, not with carrying oxygen over a distance, as hæmoglobin does, but with its control at close quarters—within the cell. They occur from yeasts to flowering plants, from insects to Vertebrates—almost universally.

Chlorophyll Pigments.—Probably much older than the hæmoglobins are the chlorophylls of green plants, for on them the process of photosynthesis depends—the building-up of sugars and the like from carbon dioxide and soil-water. Something of this sort must have been achieved before there were very successful animals, for all ordinary animals require for their food the proteins, carbohydrates and fats that have been formed by green plants or by other animals. In saying that successful animals must have been preceded by green plants, we are not forgetting that there are a few simple animals, such as the green Bell-Animalcule (*Vorticella viridis*), that have chlorophyll of their own. These are not to be confused with various green worms, green sea-anemones, green freshwater sponges, and many green Protozoa (unicellular animals), which owe their colour to partner unicellular plants (Algæ) possessed of chlorophyll. We suggest as a scientific exercise the searching out of at least six quite different ways in which an animal or part of an animal may have a green colour.

The chlorophyll of plants is much more complicated than used to be supposed; it is, indeed, a system of four pigments. Two of these, chlorophyll-*a* and chlorophyll-*b*, are essential, for they absorb red and orange rays, thus appearing green; and in the sunlight there seems to be a continual cycle of changes, chlorophyll-*a* changing into chlorophyll-*b*, with absorption of carbon dioxide, and chlorophyll-*b* changing into chlorophyll-*a*, with liberation of oxygen for which we cannot be too thankful, for this is the origin of our breathable air.

The cycle between the two chlorophylls is of great interest, because in the blood of Vertebrates the red pigment shows the same general alternation—between hæmoglobin and oxy-hæmoglobin. Along with the two essential chlorophylls, there are two yellowish pigments, carotin and xanthophyll, which seem to be much less important and belong to a different group.

Chlorophyll proper, whether *a* or *b*, has a large molecule, which is readily split, by the action of an alkali, into two parts. One of these is a complex colourless alcohol called *phytol*. The other has for its foundation four pyrrol rings, each ring consisting of C-C-C-C-N, four atoms of carbon united by one of nitrogen. The four rings are linked together in the molecule, and associated with them in some way is a single atom of magnesium, so like the atom of iron in hæmoglobin. The resemblance of chlorophyll to hæmoglobin is very striking, and it may be that the former was a stage in the evolution of the latter. But the coloured part of chlorophyll is linked to an alcohol; that of hæmoglobin is linked to a protein.

Melanin Pigments.—This third group includes dark pigments, as in the negro's skin, the Polled Angus pelage, the crow's plumage, the choroid lining of the eye, the ink-bag of sepia and other cuttlefishes. There seem to be several different kinds, but melanins are difficult to purify, since they do not crystallize, and since they are very difficult to dissolve. They always occur in the form of minute granules. They may be on the surface, as in darkish birds and mammals; but most people must have noticed the densely black pigment on the lining of the body-cavity of many fishes and other animals.

As to the nature of melanins, there is strong evidence that they are derived from tyrosine, or from some related substance. Now tyrosine is one of the amino-acids, which have been called the building-stones of living matter. All living matter consists in essential part of proteins, and proteins are chains of amino-acids, the links of the chain breaking apart in some bodily changes, such as digestion, and being pieced together in others, as when the protein framework of a cell is repaired after wear and tear.

If pure tyrosine in a test tube is treated with an enzyme or ferment called tyrosinase, which is of wide occurrence in living creatures, it becomes, on exposure to air, first reddish and finally black; and this black pigment seems identical with naturally formed melanin. This is very interesting

because the ferment tyrosinase is common and the amino-acid tyrosine is common, so that we can understand that darkish pigments should be common.

Fatty Pigments.—The fourth group of pigments consists of “coloured fat-like bodies” (chromolipoids) or “fatty pigments” (lipochromes), the technical terms being preferable since the substances in question show no great resemblance to fats, save in their solubility in ether. They are widely distributed in plants and animals, and they are often of a yellow-orange-red colour. Two of them have already been mentioned, the “chlorophyll-yellows,” carotin and xanthophyll, which occur in green plants along with the “chlorophyll-greens.” Carotin is familiar in carrots, and it gives a yellowish colour to butter. The xanthophyll of many yellow flowers crops up again in the yolk of the bird’s egg. The yellow fat of many animals, such as lizards, owes its colour to a lipochrome. Another good example is the reddish zoonerythrin (*zoon*, animal; *erythrin*, red), common in many of the crustaceans, such as shrimps, prawns, the Norway Lobster, and the Rock Lobster (*Palinurus*), which Victor Hugo called “the cardinal of the sea.” Zoonerythrin is a widespread and cheerful pigment, occurring, for instance, in the red wattle above the eye of the grouse; and it is chemically next door to the carotin of carrots. The bluish colour of a living specimen of the Common Lobster (*Homarus*) is due to this same zoonerythrin, but in combination with a protein. When the protein is destroyed by heating, the free pigment takes on its familiar red colour, so conspicuous on the lobster exposed in the fishmonger’s window.

Other Animal Pigments.—So far then, and it is no small gain, we see that the pigments of animals may be ranked in four groups: (1) the blood-pigments, *e.g.*, hæmoglobin; (2) the small group of chlorophyll-pigments, which are mostly restricted to plants; (3) the large group of melanins; and (4) the large group of lipochromes.

It would, however, be giving a false simplicity to the facts if we did not notice that there are many other animal-pigments that cannot be referred to any of these clearly-defined groups. Thus the wings of some yellow butterflies show pigments related to uric acid, and therefore to be regarded as of the nature of waste-products. The pigment of the Marbled-White Butterfly (*Melanargia galatea*) is chemically known as a “flavone,” or “flavonol,” and has been traced back to

Timothy or to Cocksfoot grass, on which the caterpillar feeds. Then there is the Tyrian purple secretion of the dog-whelk (*Purpura*) and some other sea-snails. It is the animal counterpart of indigo, just as the red pigment of the female cochineal insect is a distant counterpart of the alizarin of madder. The cochineal red is perhaps a reserve product; it is chemically a glucoside, yielding sugar when treated with dilute acid. But in an introductory survey it is probably enough to emphasize the four groups: the blood-pigments, the chlorophylls, the melanins and the lipochromes.

Uses of Pigments.—We must not embark on the large question of the uses of coloration—a fascinating question deserving treatment by itself. It is well known that some colours conceal their possessors very effectively, while others advertise their presence; some may attract or excite desired mates, while others may warn off intrusive enemies; and so forth—but let us leave this for future exploration.

The utility of a pigment is a different question from that of coloration, as is evident enough when we think of the cytochromes, which have practically no colour at all. Similarly, most people would say that a lobster's blood is colourless, though it has abundant hæmocyanin. A pigment may be of great physiological use though it has little or nothing in the way of colour; and a pigment, like the green of the bile, may be brightly coloured, although we cannot say that its colour, as colour, is of any use.

As to physiological uses, the first place must be given to the chlorophylls which make photosynthesis possible. Then come the blood pigments, such as the hæmoglobins and the cytochromes, which have to do with the distribution of oxygen in the body. It may be that some of the superficial melanins keep the glare of the sun from penetrating deeply into the body; and the absence of any pigment, as in the warm-blooded, snow-white ermine and ptarmigan, may lessen in winter the loss of the precious animal heat. In a few cases, a pigment may be a useful reserve. These must serve as illustrations; and we would close with the caution that while some animal pigments are of vital importance, others are waste-products or by-products, necessary in the normal chemical-routine or metabolism of the living body, but of no positive utility—unless we include pleasing man with their beauty!

THE IMPROVEMENT OF ENGLISH CIDER

H. V. TAYLOR, O.B.E., B.Sc., A.R.C.Sc.,

Horticulture Commissioner, Ministry of Agriculture and Fisheries.

ALTHOUGH not the oldest of English beverages, cider was certainly made in this country in early times and in very many parts of the country. The production predominated in the south-western Counties, but it also extended over Wiltshire, Hampshire, away into Sussex and Kent, and even penetrated northwards into Lincolnshire, Norfolk and Yorkshire.

Formerly cider (or—in the original spelling—sider) was made in the home for domestic consumption, and great were the qualities attributed to this drink—"which long experience hath taught do conduce very much to the constant health and long-lives of the inhabitants." The ordinary course amongst the lower class was to breakfast and sup with toast and sider through the whole of Lent, "which heighten their appetites, and create in them durable strength to labour. Sider was their physick also." This cider was very rough, often being made from the crabs and wildings of the hedgerows.

It was not until the end of the eighteenth century that the orchards proper began to be much planted. The Civil War with all the attendant troubles had passed by; continental wars prevailed for the most part, and, as foreign wines ceased to be imported, it became an object of national importance, and a patriotic duty, to encourage the home production of cider in every possible way. Squires and yeomen vied with each other in their effort to meet the national want, and the great English cider orchards of the south-west came into being. This was the golden age for cider and for cider-orchard culture. Even then, however, cider was of two kinds: a superior quality, made from the first brew, sold for use in the best establishments, and "ciderkin"—i.e., weaker cider, made by the addition of water to the must as it was passed again through the mill. This "ciderkin" was given to the men in almost unlimited quantities during haytime and harvest and formed a wholesome and somewhat harmless drink. Quantities in excess of local demands were bought up by "cidermen" and sent in those days to London and Bristol, two great centres of trade; but the great part of this, it is said, went to the Continent and returned again to this country in the shape of cheap ports and sherries.

This prosperity of cider drew the attention of the Chancellor of the Exchequer, so that taxation was imposed, sometimes on

the orchard, but generally on its produce. Farmers much resented the visits of the supervisor who collected the dues; many orchards were uprooted and a decline commenced. With the cessation of the Napoleonic War, importation of foreign wine was resumed; wines with malt liquors proved formidable rivals, leading to a falling off in the demand for cider and a general decline in the interest taken in orcharding. The orchards were let down; the quality of the cider greatly deteriorated and this common rough cider came to be a drink only of the working classes.

Happily a reaction has now set in and cider—not the rough cider of the “eighties,” but a high-quality beverage—has again become a favourite drink with people of all classes, and sales show an annual increase. It is perhaps impossible to indicate with strict accuracy the exact quantity that is made or sold for no returns are made, but duty was paid on cider from 1916–1922. The following figures for this give some measure of the quantities of cider sold during those years, although not entirely an accurate one, since farm-made cider was exempted from the duty, the quantities of this class are not indicated in the returns.

						Gallons
1916–17	..	..	..	..	..	4,218,960
1917–18	..	..	..	..	..	8,633,400
1918–19	..	..	..	..	..	8,035,200
1919–20	..	..	..	..	..	3,570,840
1920–21	..	..	..	..	..	5,070,000
1921–22	..	..	..	..	..	5,418,480
1922–23	..	..	..	..	..	6,596,220
						41,543,100
Average						5,934,728

No duty was paid after 1923, and no further figures are available, but those in the trade are of opinion that the sales of cider have now become considerably larger than the $6\frac{1}{2}$ million gallons, on which duty was paid in 1922–23. Probably the quantity now sold is double this or nearly so.

How Present Supplies are Maintained.—The home supplies of cider distributed at present are, in the main, made (a) from home-grown apples; (b) from apples imported from France; (c) with cider imported from France. Before enlarging on the supplies from these sources, it is necessary to delve a little deeper into the cider question and consider which apples are most suitable for making cider. Of course the juice of every apple will make cider, but not all would be appreciated as a drink.

Apples for Cider Making.—Far back in the ages, cider makers had found out the kinds of apples that made the best cider. Such varieties as Kingston Black, Foxwhelp, Styres, Restreak, and Royal Wilding were famed; although generally it was found that beverages of the better class and flavour came from mixed varieties. Opinion was naturally hazy, however, as to what the best blend should be. This absence of exact knowledge gave the chance to the “sharp” men who devised all kinds of mysterious practices and sold “charms” for improving the cider brew.

The scientific work of the National Fruit and Cider Institute, since its establishment in 1903, whilst it has supported the use of blended juices, has done much to furnish the knowledge which justifies this practice. Thus, the modern view, framed as a result of this work, would seem to be that, for cider-making purposes, apples may be divided into three distinct classes, (a) the sharp or high acid group; (b) the sweet or low acid group; and (c) the bitter-sweets or varieties which, although low in acid, are rich in tannin. Relatively few apples have their contents of natural acidity and tannin balanced in the best proportions for the acidity and astringency desired in good cider, but that drawback is readily overcome by blending. Given sufficient fruit of each class, it is possible by blending to produce a cider of any desired standard of acidity and astringency.

The Supplies of Fruit.—*Cider Fruits.*—The orchards of the West, famous in olden days for cider apples, supplied large quantities of each class, and manufacturers could find sufficient quantities of each type. There were trees of Kingston Black, Tom Putt, Foxwhelp, etc., of the sharp class; Morgan Sweet, Improved Pound, Sweet Alford, etc., of the sweet class and Cherry and White Norman, Chissel Jersey, etc., of the bitter-sweet class, all giving juices that blended well to make the real vintage ciders. When the lean days came upon the cider industry, the orchards were either let down, or the trees were regrafted to other kinds. Where fresh trees were planted, these were not cider varieties but Blenheim Orange, Warner's King, Bramley's Seedling to give the grower the chance of selling his apples in the market for domestic use. As all these market apples belong to the high acid type, supplies of this class did not diminish but rather showed an actual increase, whilst the sweet class, and especially the bitter-sweet class, rapidly declined until an actual shortage has occurred.

That is why the present supplies of home-grown apples are unbalanced for cider making.

Culls of Market Fruits.—In the meanwhile, fruit growing of market varieties (culinary and dessert) had progressed rapidly in Kent, the Eastern Counties, Norfolk, the West Midlands and actually, also, in the cider counties of the South-West ; and, as the "culls" from these market fruits became available for cider making, the supplies of the high-acid sorts were further increased.

There is thus an abundance of fruits of the "high acid" type which it may be difficult to utilize to the best advantage unless, also, adequate supplies of the bitter-sweet class are grown to effect a proper blend.

The culls of all cooking and dessert varieties and the high-acid apples will make a cider which is not properly balanced ; it contains too much acid, has a rate of fermentation which is too rapid, and lacks body. When this thin cider is blended with that made from apples of the bitter-sweet class the want of balance is somewhat rectified.

The analysis figures given in the table below for ciders made (a) from blended cider varieties, (b) from Bramley's Seedling culls and (c) from a mixture of Bramley's and the bitter-sweet Dabinett show only too well the defect of cider made from Bramley's Seedling as compared with the blends. The high acidity of the Bramley's Seedling cider has been reduced from 0.84 to 0.5 of malic acid by the mixture of Dabinett, the tannin having been increased from 0.1 to 0.15 and the rate of fermentation lowered from 9.4 to 7.0. The figures for this blend show that the cider from the Dabinett and Bramley's Seedling is still inferior to that made from vintage cider fruits.

ANALYSIS OF CIDERS

(The National Fruit and Cider Institute, Long Ashton, Bristol, 1929)

<i>Fruit used</i>	<i>Final Sp. G.</i>	<i>Malic Ac</i>	<i>Tannin</i>	<i>Rate of fermentation</i>
(a) Mixed cider varieties	1.024	0.47	0.24	3.7
(b) Bramley's Seedling	1.020	0.84	0.10	9.4
(c) { $\frac{1}{2}$ Bramley's Seedling $\frac{1}{2}$ Dabinett }	1.025	0.50	0.15	7.0

All the high-acid fruits, however, can be absorbed in the cider industry provided the industry can secure sufficient quantities of the bitter-sweet and sweet classes to blend with them to make the cider balanced and palatable.

The bitter-sweet apples are at present grown in large quantities in France, particularly in Normandy and Brittany,

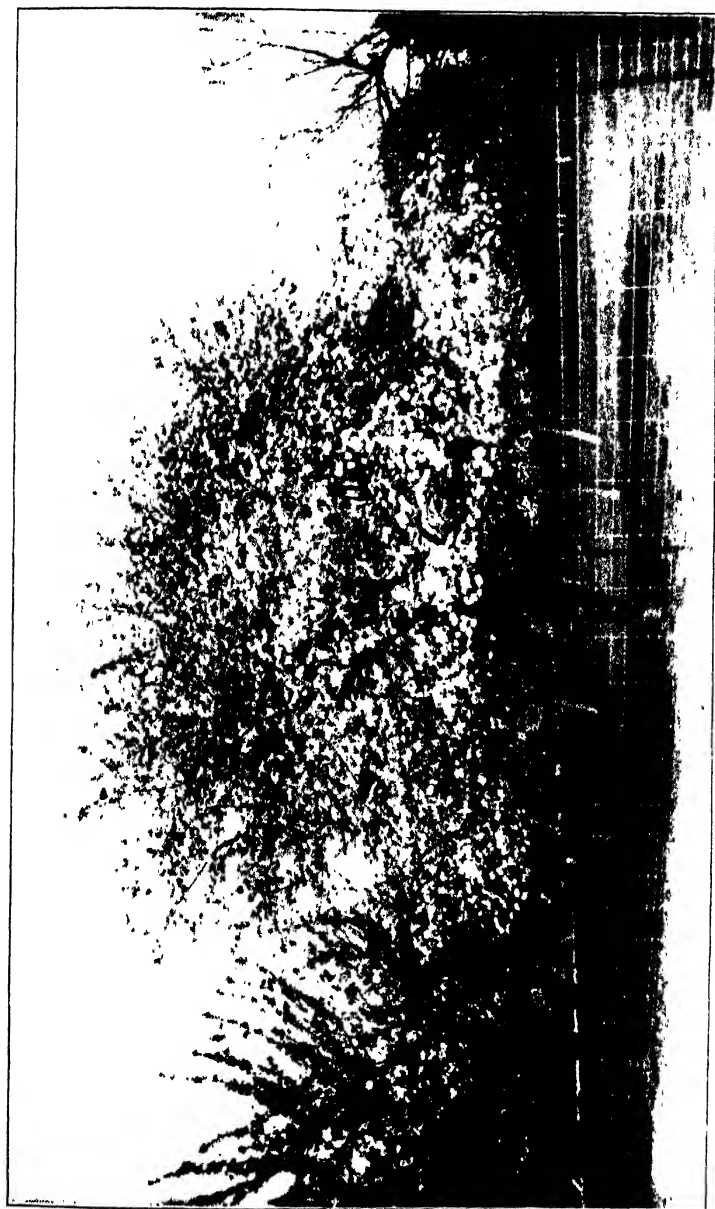


FIG. 1.—Sweet Alfred apple tree (planted 1903-4) in full bloom. Note the dwarf, spreading habit of the tree.
THE IMPROVEMENT OF ENGLISH CIDER.



FIG. 2.—Knotted Kernel apple tree (planted 1903-4). A vigorous, upright-growing tree.



FIG. 3.—Dwarf apple tree (planted 1903-4). A dwarf and spreading tree.

from which districts the English factories purchase large supplies, whenever France can spare them. This is by no means a satisfactory position either for the cider makers or for the English growers, for should the French crop run short the English cider makers are not able to obtain the full quantities of "bitter-sweets" and so cannot use as many of the English high-acid class as is desired. Statistics perhaps reveal the magnitude of the position rather well.

In 1925, the production of dessert and cooking apples in England and Wales was estimated to be 6,520,000 cwt. On an estimate, 10 per cent. of these will be "culls"—that is, 652,000 cwt. will be available for making cider. These "culls" cannot be used properly for cider-making unless there are available not less than 652,000 cwt. of "bitter-sweet apples" to mix with them. A number of bitter-sweet apples are grown in the south-west, but the quantity available is only sufficient for blending with the ordinary cider fruits, so few can be used for the market culls.

The English fruit growers outside the south-western counties have given little consideration, so far, to this matter, nor have they attempted to grow these "bitter-sweet" apples. There is every reason, however, for thinking that these "bitter-sweets" would grow just as well in other parts of England as they do in the south-west (or in France), and, perhaps, under the modern orcharding conditions practised in the fruit areas proper, might give even better crops.

It is realized that the fruit grower in Kent, Norfolk or the Isle of Ely may not wish to become a large grower of cider apples, or to have a whole range of varieties such as is found in the south-western orchards; but each grower might find it desirable and profitable to grow just one or two varieties of the "bitter-sweets" to supply sufficient to blend with the "culls," of Bramley's Seedling, Worcester Pearmain, Lord Derby and Lane's Prince Albert—to enable all to be sold to the cider factory. Certainly, the cider factory would find it more convenient to be able to purchase all from one source than to purchase the high-acid fruits in England and the "bitter-sweets" in France. The research work done in recent years at the National Fruit and Cider Institute suggests that the three varieties known as Knotted Kernel, Dabinett and Sweet Alford are well suited. The Knotted Kernel is a large and vigorous grower which make a fine tree; the Dabinett is less robust, although it comes into bearing at an earlier age. Both are reliable croppers and supply just the "bitter-sweet type"

of apple that is in demand by the cider industry. The Sweet Alford is a desirable sort of the "sweet type."

Detailed particulars of the three varieties are as follows :—

Knotted Kernel.—Bright Crimson apple, rather small. Good quality. Bitter-sweet. Very vigorous grower, upright, spreads with age. Generally rather late coming into bearing, then a heavy cropper.

Dabinett.—Green with a dull crimson cheek. Moderate grower, flat-headed. Heavy cropper.

Sweet Alford.—Pale primrose yellow, red cheek, medium size, a very good sweet variety. Strong grower, good cropper.

If fruit growers in all parts would provide just sufficient of these "bitter-sweet" and sweet apples to blend with their "cull" fruits, the cider factories and the cider makers should be able to purchase at home sufficient supplies of properly blended fruits as would enable them to make and sell a British vintage cider made wholly from British apples.

The National Fruit and Cider Institute, Long Ashton, Bristol, have promised to advise growers as to sources of trees or grafts of the varieties named, and sufficient quantities are available for all who care to plant.

* * * * *

THE LIFE HISTORY OF BROCCOLI

F. R. HORNE, M.A. (Cantab.), N.D.A., N.D.D. (Hons.),
*Head of the Biological Department, Seale-Hayne College, Newton
Abbot.*

BROCCOLI is the name given during growth to winter hardy cauliflowers. It includes a number of very distinct strains, of which some yield the most valuable cauliflowers on the market. The plant is of considerable value as a field crop in the south-west of England, notably in the Mount's Bay area around Penzance, Cornwall, where it has been estimated as worth £100,000 annually to the district. It is also grown on a field scale in Kent and in other parts of the Kingdom.

The seeds cannot be distinguished even by the closest examination from other forms of cabbage, although they are much larger and browner in colour than turnip seeds. Curiously enough, a difference has been found between strains of Broccoli, the "Roscoff" strain possessing smaller and often darker seeds than the Cornish strains.

The seeds are generally sown along a headland on well cultivated ground in mid-April. During normal seasons, this allows sufficient time for the development of the young plants, but, in dry weather, germination and early growth may be seriously checked. The average time taken for germination is 14 days, and experiments conducted at this College indicate

that the extent of consolidation in the seed bed has a very profound influence upon the rapidity of germination. Under normal conditions, it was found that rolling the soil after sowing hastened the appearance of the seedlings by two days. Under dry conditions, the difference in the rate of germination as between a rolled and an unrolled seed bed is as great as ten days in favour of the rolled. Incidentally, it appears that the husk of a seed coat after germination remains underground or is carried up together with the seed leaves according to whether the soil is loose or fairly well consolidated. When the soil is loose, the husk is usually carried above ground with the seed-leaves, but, in consolidated soil, it remains below the surface. Fig. 1 shows, at the left hand of the top row, a plant that was grown in loose soil, whilst the others were in consolidated ground.

Seedling Stages.—The seedling in its earlier stages does not differ markedly from seedlings of closely related forms, such as those of cabbage and kale. It is not until the first foliage leaf has been produced between the two kidney-shaped seedling leaves that it acquires any distinctive appearance. At this stage, the leaves are of a much lighter colour than the corresponding leaves of other plants of the same family, whilst the edges of the third and fourth leaves are bluntly toothed. (Fig. 1, lower row.)

Where a valuable and limited stock of seed is available, the plants are often pricked off into beds on reaching this stage, each plant being allowed an area up to three square inches. Tests during the last two seasons show that this additional transplanting raises the average size of the plants at the time of maturity, and increases the proportion of first-grade marketing heads. The effect is due to the increased root system which develops when the plants are spaced at an early age; during a dry July the advantage is most remarkable, as the plants proceed almost without a check after the final transplanting. Between germination and the transplanting stage, growth appears to be slow, as the number of leaves does not usually rise above six; the older and smaller lower leaves, however, are being replaced by larger young leaves nearer the tip.

Transplanting.—By early June, the plants are ready for final transplanting, having reached the stage shown in Fig. 2. Experiments at this College have shown that the earlier in July the plants are moved into permanent quarters, the more uniform are the marketable heads. During the three months that follow midsummer, the greater part of the growth of leaves

and stem occurs, and it has been found that when the plants are not well rooted by the end of July, at least 10 per cent. of the plants fail to form a marketable head. In the Penzance district the time of transplanting is often limited by the date at which a preceding early potato crop can be cleared.

The specially rapid growth of leaves and stems during early autumn, and the formation of heads in spring, necessitate careful manuring. An application of dung is of the greatest importance, as it will encourage the formation of big well-rooted plants; a dressing varying from ten to fifty tons per acre is usually given. It is found that only well-rotted dung, ploughed into the soil at least a month before transplanting, leads to the steady growth that is desirable. It has also been found that a dressing of dung alone leads to the plants developing small heads and maturing later in the spring than otherwise. To counteract these tendencies, and to give the highest possible production of heads, superphosphate at the rate of 5 cwt. per acre has been found very successful. Bone meal at the same rate is also favoured by growers. Forms of potassic and nitrogenous manures are also frequently given and, under the appropriate conditions, undoubtedly lead to an increased yield. Kainit at about 6 cwt. per acre improves the colour and healthiness of the leaves and should be given with the phosphatic manure. A dressing would probably be well repaid on light soil or where broccoli follow a cereal crop on a mixed farm.

Nitrate of soda is very popular as a top dressing, and has been shown to accelerate growth in the last two months where the plants are small and the leaves pale coloured. On no account, however, should nitrogenous manures be applied to areas when it is intended to save the plants for seed, as a reduction of as much as 50 per cent. in the yield of seed may result.

Early Differences between Strains.—Differences in type between different strains are first visible at Michaelmas. Plants of most of the old Cornish strains show a long and strong stem, with the leaves fairly loosely arranged and with a coarse curly edge. Plants of the so-called Roscoff strains, on the other hand, show a shorter, stouter and more tapering stem, with the leaves more compactly arranged. A typical Roscoff plant at this stage rather resembles a half open rose, all the leaves being slightly cup-shaped. There is a third distinct type marked by light bluish-green leaves, which are very blunt tipped and erect in position. This type was, unfortunately, very abundant in the thirteen commercial "Roscoff" strains



FIG. 1. The upper row shows seedlings immediately after germination. The left-hand plant was germinated in loose soil. The lower row shows plants ready to be pricked out.



FIG. 2. Plants ready for transplanting. Note large root systems due to auxin treatment.



FIG. 3. A Roscoff plant of "late" type ready for cutting for the English market, showing head and leaf characters (inner leaves only focussed)



FIG. 4. Three branches from one plant with equal numbers of flowers. A (left hand) cross-pollinated by hand; B (centre) self pollinated; C (right hand) naturally cross-pollinated.

under trial during the season 1929-30, and is generally known as the Angers type. The plants mature fairly early and give a loose, generally yellowish-white head with closely twisted leaves.

Besides the differences between strains of different origin, it has been found at this College, in testing the commercial stocks of seed, that early and late strains show different characteristics by the end of September.

The predominant type of plant in late strains is usually larger and has more numerous leaves, while individual leaves are dark green with white veins. They are also often slightly curly along the edge, and have a pointed tip. The commonest type of plant in the early strains is more compact, and the leaves tend to show a rather grey-green surface and to be blunt at the tip. The plant shown in Fig. 3 is distinctly of the late type.

The Roscoff strains show many distinct types of plants, and it is hoped to obtain a really good "first early" and a "dead late" strain of Roscoff broccoli, just as there are now Cornish strains for these difficult periods of marketing. At present the various strains of Roscoff mature during the "mid-season" period in February and early March, although some are claimed to be "early" strains.

The Head of Flowers.—Growth is checked when the maximum day temperature drops below about 50° F., but development inside the head continues slowly. By early November in the early strains, and by the end of December in the late strains, the malformed heads may be seen by cutting away the leaves.

The "head" which is later to be marketed is formed by a very early production of flower buds from the tip of the main stem and the branch stems below. It appears that growth in the broccoli is diverted from leaf to flower development at just about half the age at which this occurs in the cabbage. A cabbage usually shows no sign of flower production before it is a year old, but the broccoli at six months has a stem in which elongation is suspended, but development proceeds apace.

Observation has shown that side branches are produced in order from below upwards, but so well regulated is the rate of growth that, in a first class cauliflower, all these branches are kept with their tips together making a hemispherical dome. Moreover, in the best heads, it appears that all the side branches arise from almost the same level, giving the head the appearance of an umbrella when cut downwards into two halves (Fig. 3).

The spherical heads produced in this way are the most

attractive in appearance and are the more easily packed and transported. This character of producing spherical heads is of great economic importance in deciding the value of a broccoli strain, and it is interesting to note that it is to be found in some individuals of the best old Cornish strains although it is characteristic chiefly of the Roscoff strains.

The Marketing Stage.—The side branches, on growing into an umbrella-like formation, are seen to be covered by irregular white discs at the tops, which are closely packed to form a hemispherical covering. This is the edible portion and it is composed of approximately two to three thousand flower buds. Even at this early stage, a stalk and four very fleshy sepals in each flower can be discerned by the use of a microscope, but the other parts are undeveloped. Two conditions help to decide the value of the plant at this stage—regularity of growth and protection of the head.

If the flower buds are uniform in size, and are all developed at the same height, the marketable head has a distinct and regular grain and it is said to show a good “curd.” The so-called woolly heads are those in which the individual flower buds are irregular instead of spherical in shape.

The colour of the flower buds and, consequently, the cauliflower head, is much affected by exposure to climatic conditions, being dead white where well protected, and a dark buff colour where freely exposed. Protection is given by the innermost leaves, which are incurved and sometimes slightly twisted in good plants. The late plant photographed in Fig. 3 is fairly well protected, and very little of the four-inch head is to be seen from above. In a good plant the head may reach a diameter of six inches without being visible until the leaves are removed.

In exposed positions, such as the botanical grounds at the Seale-Hayne College, it has been found that protection of the base of the head by the bases of the outer leaves is also very important. Where the outer leaves are not “feathered” to their base, but show a distinct stalk, the head is liable either to be mottled in colour, owing to the action of rain, or softened by frost. Attention is therefore being paid to the width of the outer leaves at their bases in selecting the best plants for breeding.

It is largely due to their perfect whiteness that all the better strains of broccoli give the best cauliflowers that come on to the market during the year. They surpass in shape, colour and general appearance the autumn-maturing cauliflowers, which are mainly raised from Italian seed. To avoid confusion, there is much to be said in favour of including the winter-hardy

cauliflowers or broccoli under the term "cauliflower," even whilst growing, as they are always marketed under this name.

The exact stage of cutting varies with the requirements of the markets. For the English markets, a diameter of four inches is generally most popular, but for the continental markets the head is allowed to become fully six inches across. The time required for this increase in size is only from about three to eight days, depending upon the temperature.

Pollination.—The head grows rapidly to a diameter of about eight inches, after which it begins to break because the individual branches then elongate irregularly. After this stage the head is very liable to damage by frost and, with the earliest strains, sometimes the entire crop of seed is lost through a frosty spring. Experiments are being carried out at the College to determine the best method of checking development after the marketing stage is reached, so that the tender branches are not exposed until the hardest frosts are over. One promising method appears to be that of moving the plants directly into a shaded, but frost-protected area—such as the headland below a well-grown hedge. Another is to lift the plants and to store them in a cool building, with a good spadeful of earth secured round the roots by a sack, until the weather is milder. The former method entails less risk to the plants, and less labour, but does not suspend growth so effectively as the latter method.

Stems rapidly develop to a length of two feet or more, giving the plant a shrub-like appearance, and the flowers then begin to develop. Many flower buds are aborted, but others become green and develop into typical yellow cabbage flowers. Between 500 and 1,000 flowers are generally produced at the height of flowering, which may be at any time between late May and early July. It has been found at this College that the order at flowering does not follow closely the order at marketing time, and considerable overlapping occurs between early and late strains. Where seed is being saved from plants of both strains in close proximity, very considerable inter-crossing occurs with consequent loss to both strains.

Honey bees are the most active carriers of pollen, but humble bees often take part. Both bees will seek broccoli flowers from a distance, and observation has shown that each flower is usually visited twice or three times by bees. It is the earliest visit that normally leads to fertilization as the stigma is exposed at an early stage and is in a very prominent position. Later visits lead to pollen being removed from the bursting stamens and left on other flowers.

Cross-fertilization is the most usual natural method of reproduction, and not only will pollen from different types of broccoli serve the purpose, but also pollen from any flowering cabbage, sprout, kale, etc., and sometimes even from turnips. Few plants when first self-pollinated will give uniform progeny, on account of the perpetual inter-crossing that has occurred in previous generations, and it has been found impracticable to self-pollinate twice in successive generations of broccoli owing to the considerable loss of vigour that has resulted.

The establishment of a valuable strain in such a plant must depend chiefly upon the breeder's power to select two plants of similar genetical constitution as parents for the strain, so that a type both desirable and uniform can be obtained.

Seed Production.—Two months after pollination, the seed is generally ready for harvesting, and the entire plant, or branches of the plant, are removed for final drying in a shed. A fair yield from a normally cross-pollinated plant is between one and two ounces of seed, though very early strains rarely give more than one ounce per plant. Under self-pollination anything from 0 to 10,000 seeds may be obtained per plant; individuals vary very much in their power to produce seeds under this treatment.

Fig. 4 shows three branches with the seed set under different treatments. The right hand branch (C) was exposed to natural cross-pollination; branch (A) was carefully pollinated with pollen from another plant; whilst the middle branch (B) was carefully self-pollinated. It will be noticed that self-pollination in this case only provided a single seed, whilst natural cross-pollination produced the most.

It is interesting to note the strong tendency of natural forces to encourage the development of plants that are mediocre in the time of maturing and in type. Valuable early and late strains of broccoli tend to be lost by intercrossing with the mid-season strains, and particularly good types of plants do not produce equally valuable offspring on account of the influence of less valuable types during pollination. The production of well-defined and valuable commercial types, and the preservation of these by carefully regulated breeding, is, therefore, of great importance to the industry.

WEEDS OF GRASS LAND—III*

H. C. LONG, B.Sc. (Edin.),

*Ministry of Agriculture and Fisheries.***General Methods making for Improvement (continued).—**

Grazing.—The great influence of judicious grazing on grass land is widely recognized, but it is essential to bear in mind that grazing will be most effective in bringing about improvement when it is associated with other factors already mentioned or to be discussed below. It is generally accepted that grazing is at its best when it involves the use of mixed stock, or different classes of stock following one another. Grazing by horses alone is notoriously a bad practice, since these animals are rather fastidious in their choice, taking only the best of the herbage. Cattle are much less selective, but will avoid the roughest material as long as better grazing is plentiful; but it is wonderful what a lot of roughage a bunch of hungry cattle will clear up in the autumn. Sheep graze very closely, and will often consume weeds that other stock reject. At the same time they are more selective than cattle, and, as Stapledon and Hanley put it,† “the introduction of cattle is the best corrective for the ill effects of horse or sheep grazing.” When it is possible it is best to graze with more than one class of stock, say horses and dairy cows, followed perhaps by store cattle, and finally dry ewes. Close grazing with sheep has long been practised for the purpose of reducing certain troublesome weeds, such as yellow rattle and ragwort.

To ensure even growth of good herbage it is essential that all grazing land that gets rough should have the mower run over it in late summer, in order to prevent the accumulation of coarse tufts of unpalatable grasses. If stocking is sufficient, subsequent growth will not be patchy and coarse. Droppings should be distributed by harrowing, or the development of ugly patches that stock refuse to touch will certainly occur to the detriment of the pasture.

The recently-introduced practice of frequent manurial treatment associated with sectional and close grazing, in special cases where pasture is limited, is calculated to lead to a real reduction of the weed flora.

Salting.—Just how far salting of pastures makes for a reduction of weeds generally is not clear, but many farmers regard it as a useful means of improvement. Apart from any

* Previous articles appeared in the issues of this JOURNAL for December, 1930, p. 871, and January, 1931, p. 985.

† R. G. Stapledon and J. A. Hanley, *Grass Land*, 1927.

possible inhibitive action it may have upon individual weeds, such as yellow rattle, an application of 4 to 6 cwt. of salt is believed by some farmers to make the pasture more attractive to stock, which therefore graze and tread it more closely and thoroughly.

Cutting Individual Species.—Early mowing as a means of reducing annuals has already been mentioned; it may be added here that some species of grassland weeds must receive individual attention. Among these species are thistles, hard-head or black knapweed, ragwort, ox-eye daisy, tufted hair-grass or "bull pates," dyer's greenweed, rest harrow, rushes and sedges and other perennials. These must all be cut over, sometimes more than once, and on small areas some of them may be most satisfactorily dealt with by hand pulling.

Clean Seeds.—Finally, it may be well to emphasize the importance of using only clean seeds when laying down land to temporary or permanent grass, or when sowing renovating mixtures. The sowing of impure seeds is a ready means of introducing weeds to a farm. In this connexion it is a bad practice to give poor weedy hay to stock on pastures, or to scatter hay-loft sweepings on grass land with the intention of helping it to fill up: such action is likely to lead to the introduction of many docks. It is desirable to take the greatest possible pains to ensure a clean pasture to start with, and thereafter care should be taken so to manage the pasture that "weeds"—worthless grasses and other plants—shall be kept down. Nearly 170 years ago Stillingfleet wrote:*

"If a farmer wants to lay down his land to grass, what does he do? he either takes his seeds indiscriminately from his own foul hayrick, or sends to his next neighbour for a supply. . . . By this means . . . a certain mixture of all sorts of rubbish . . . must necessarily happen.

"Some say then, that if you manure your ground properly, good grasses will come of themselves. I own they will. But the question is how long it will be before that happens, and why he at the expence of sowing what you must afterwards try to kill by manuring? which must be the case, as long as people sow all kinds of rubbish under the name of hay seeds."

Stillingfleet's indictment of farmers for sowing bad seed is fortunately not applicable at the present day, but his implication of the effect of manuring is still true. As he suggests, however, it is unwise to commence with a bad weedy pasture, on which much labour must be expended to get it into good condition.

Summary.—Among the general methods that will make for improvement have been mentioned drainage, liming, manurial

* Benjamin Stillingfleet. "Observations on Grasses," pp. 365, 366, *Miscellaneous Tracts Relating to Natural History, Husbandry and Physick*. 2nd Edition. 1762.



FIG. 1. MOUSE-EAR CHICKWEED (*Cerastium vulgatum* L.)

a. Seeds natural size and $\times 15$; b, early stage of seedling $\times 1$; b', surface view of cotyledon $\times 1$; c, second stage of seedling $\times 1$; d, third stage of seedling $\times 1$; e, flowering portion $\times 1$.

WEEDS OF GRASS LAND

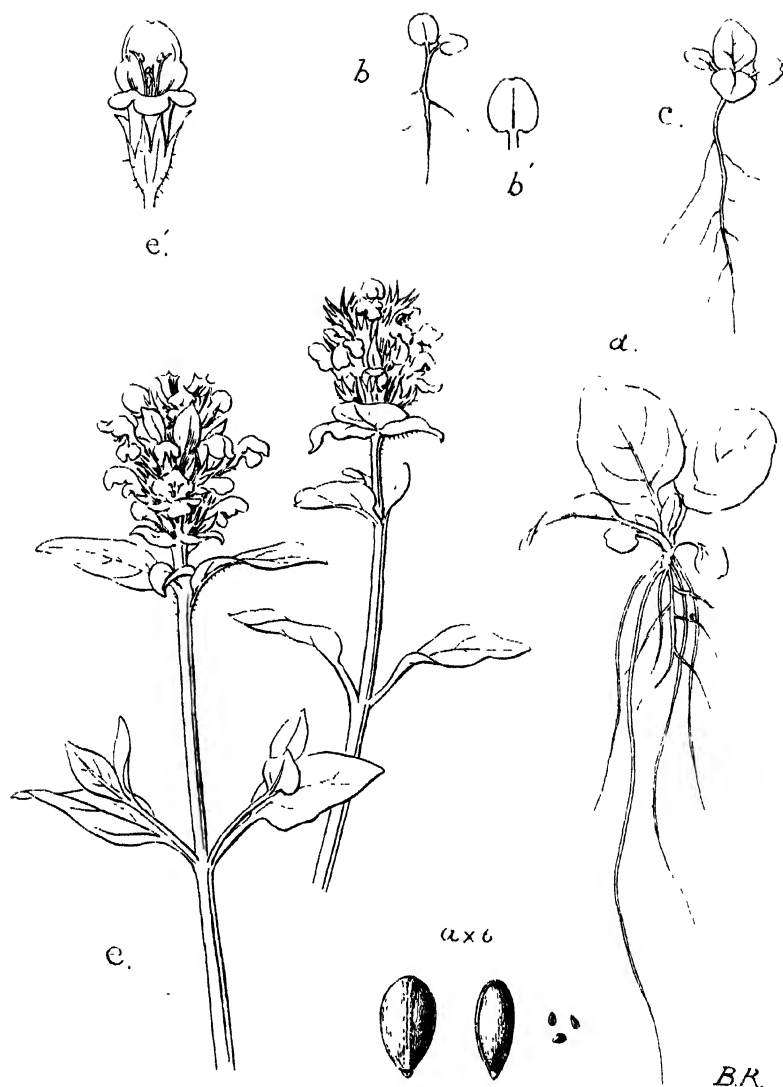


FIG. 2.—SELF-HEAL (*Prunella vulgaris* L.).

a, Seeds, natural size and $\times 6$; *b*, first stage of seedling; *b'*, surface view of cotyledon; *c*, second stage of seedling; *d*, third stage of seedling, *e*, flowering stem (*b*, *c*, *d* and *e*, natural size); *e'*, flower (enlarged).



FIG. 3.—RIBWORT PLANTAIN OR RIB-GRASS (*Plantago lanceolata* L.).

a, Seeds, natural size and $\times 5$; *b*, *c*, and *d*, first, second and third stages of seedling $\times 1$; *e*, flowering plant $\times \frac{1}{2}$; *e'*, flower (enlarged).

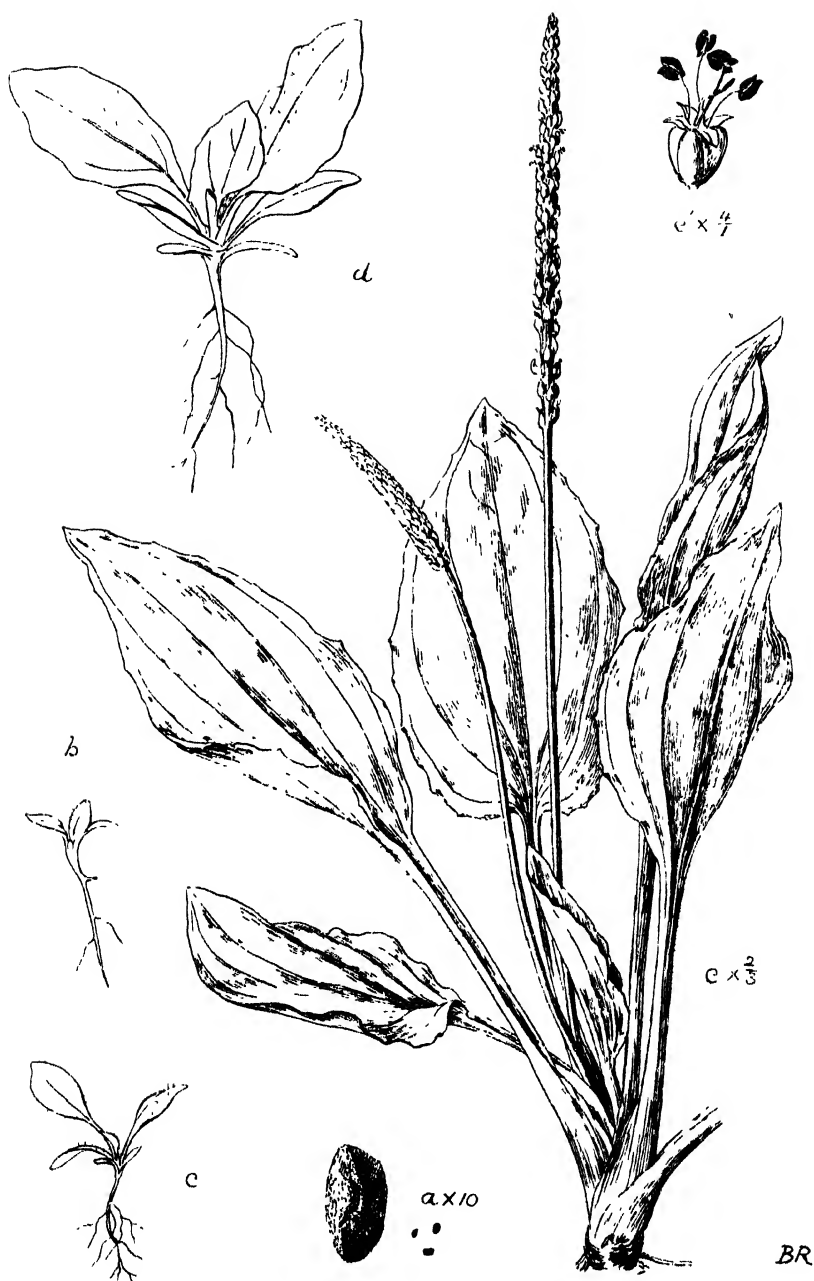
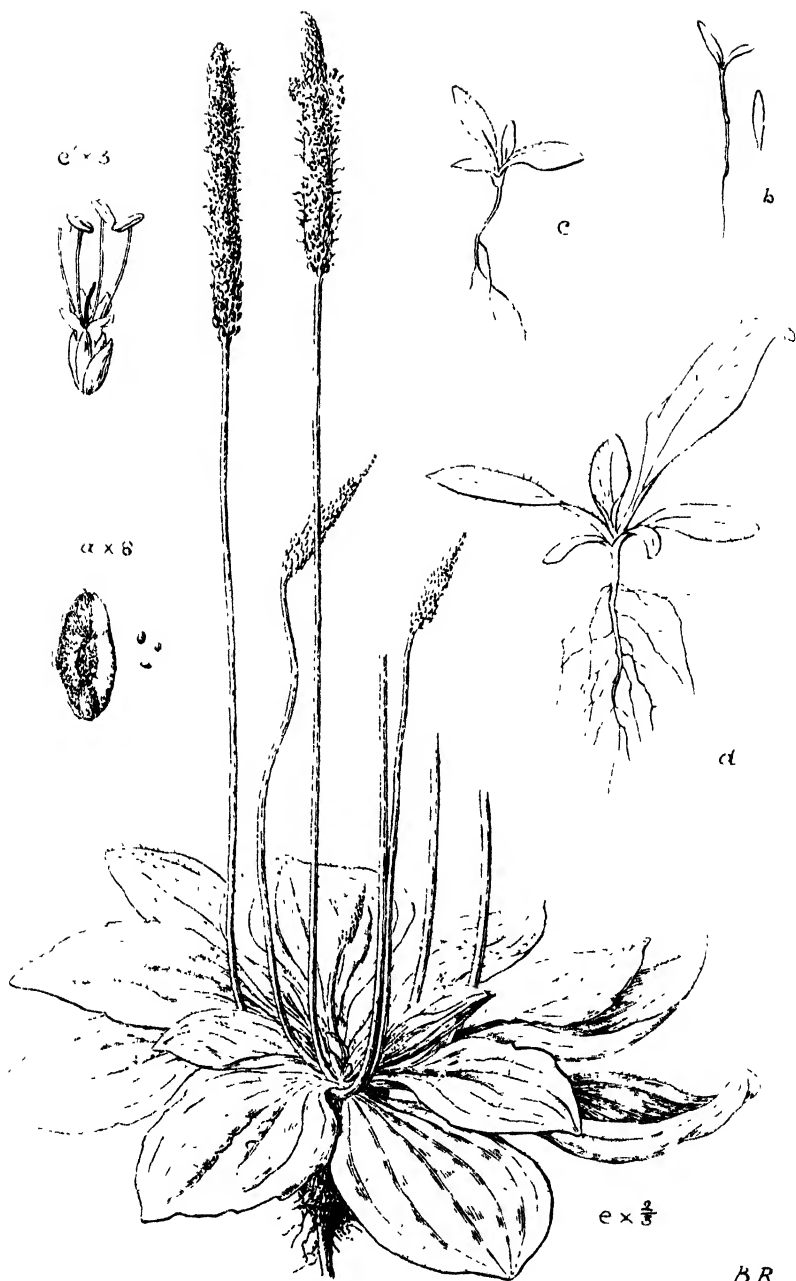


FIG. 4. BROAD-LEAVED PLANTAIN (*Plantago major* L.).

a, Seeds, natural size and $\times 10$; *b*, *c* and *d*, first, second and third stages of seedling $\times 1$; *e*, flowering plant $\times \frac{2}{3}$; *e'*, flower $\times 4$.



B.R.

FIG. 5. —HOARY PLANTAIN (*Plantago media* L.).

a, Seeds, natural size and $\times 8$; *b*, *c* and *d*, first, second and third stages of seedling (natural size); *e*, flowering plant $\times \frac{2}{3}$; *e'*, flower $\times 3$.



FIG. 7.—WILD ONION (*Allium vineale* L.)
The plant in the young state, winter and early spring

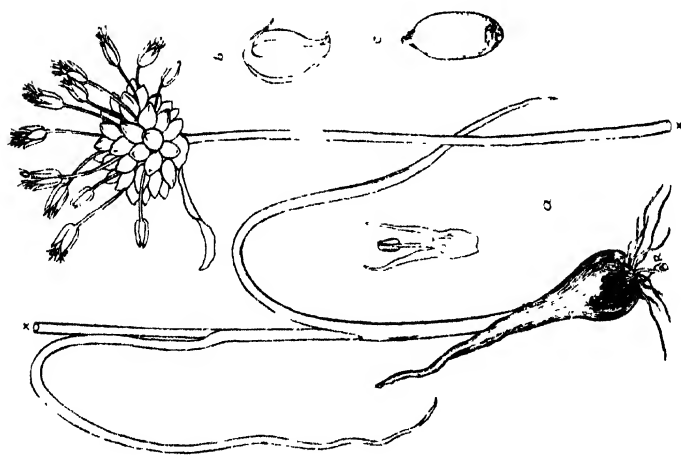


FIG. 6.—WILD ONION (*Allium vineale* L.).
a, Bulb and flowering stem (reduced); *b*, aerial bulblet, and
c, wheat grain (slightly enlarged).

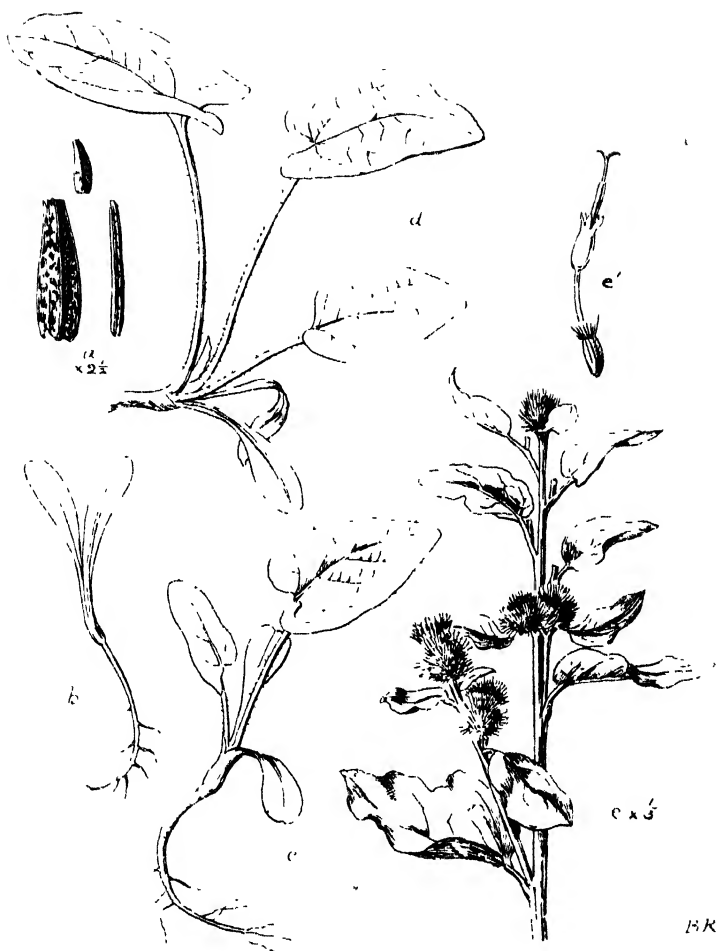


FIG. 9. THE BURDOCK (*Arctium lappa* L.).

a, Seeds natural size and $\times 2\frac{1}{2}$; *b*, *c* and *d*, first, second and third stages of seedling $\times 1$; *e*, flowering portion $\times 1$; *e'*, flower, enlarged.

treatment, harrowing or mechanical treatment, clearing scrub and bushes, sowing of wild white clover, mowing tufts and roughage, early mowing of grass for hay, cutting surplus grass for hay or silage, consolidation, grazing, salting, cutting of individual species, sowing clean seeds.

An attempt may now usefully be made to deal individually with a few of the worst weeds of grass land. Only a limited number of representative species, however, can be considered in these articles; it is hoped later to issue a Bulletin containing these articles together with notes on other species of grassland weeds.

It may be noted at the outset that the Natural Orders contributing the largest numbers of weeds are the *Ranunculaceæ*, *Cruciferae*, *Caryophyllaceæ*, *Rosaceæ*, *Umbelliferae*, and *Compositæ*, the last named being especially prolific in weeds of a harmful character.

Lady's Smock (*Cardamine pratensis* L.), known also as Cuckoo Flower or Bitter Cress, is a common and well-known perennial flower of damp, low-lying meadows and pastures. It is about a foot high, with pinnate leaves; the conspicuous flowers are about 1 in. across, lilac in colour, and, like other crucifers, the four petals are arranged in the form of a cross. The flowers appear from April to June.

This species is hardly of great economic importance, but it is an "indicator" plant, and may sometimes occur in quantity. The general methods applicable for the improvement of land of the type on which it is common—drainage, liming, judicious manuring and grazing—will certainly diminish it.

Mouse-ear Chickweed (*Cerastium vulgatum* L.) is a frequent and prolific weed of meadows and pastures, and may occur on almost any kind of soil. It is usually perennial, and is a slender, straggly, procumbent, downy plant (Fig 1), with small oblong-lanceolate leaves placed opposite each other in pairs on the stem; its clusters of small white flowers are arranged on short stalks, and appear from April to August. Owing to its lowly habit, it is often difficult to determine just how serious its presence may be, but it occurs in plenty all over the country. It has been already stated that this weed was found 49 times in 80 turves in Dr. Fream's investigations. It is to be found on grass land generally, but more especially upon poor and unimproved land in need of good treatment. The weed frequently occurs in patches, which should be mown close with the scythe before seeding takes place, and

better grasses and clovers should be encouraged by manuring and close grazing. The seeds of mouse-ear chickweed may occur in samples of white clover and alsike seed, and in samples of grass seeds.

Self-heal (*Prunella vulgaris* L.) is sometimes very troublesome in poor pastures and meadows. It is a somewhat hairy perennial, 6 to 12 in. high, with a square stem, and almost oblong opposite leaves, the lower pairs of which are stalked and the upper sessile. The plant has a creeping rootstock. The small, reddish-purple, two-lipped flowers occur in whorls in dense terminal heads (Fig. 2), and open from July to September. Samples of impure clover seeds are apt to contain the almost egg-shaped seeds of self-heal, so that care should be taken to ensure pure seeds for sowing.

This plant occurs naturally in damp grass land, and is held to indicate poor, sterile soil; in Scotland it is known by the name "Blaw-weary." Close grazing with sheep, and sound judicious manurial treatment, will effect an improvement in the herbage and a reduction in the weed. On heavy land basic slag is useful in checking it, and on light soils superphosphate.

The Common Bugle (*Ajuga reptans* L.), another perennial, is somewhat similar to self-heal, but more handsome if equally lowly. The stems are 6 to 12 in. high, and the leaves sessile and ovate. The blue flowers are arranged in loose whorls in longish spikes (2 to 8 in. long). They open from May to July. The plant, which is common by roadsides and in medium to poor grass land, is spread by seed and by stolons or runners. It may be reduced in the same way as self-heal.

The Common Daisy (*Bellis perennis* L.) or "Day's Eye," is too well known to need description here. It occurs on almost all soils in poor pastures and meadows, and on lawns, flowering almost all the year round. The rosettes of leaves lying flat on the ground prevent the growth of grasses and clovers, as may at once be seen on cutting off a daisy plant below the crown and removing it, a bare patch being left. It is sometimes present in such excessive quantity in pastures that much loss of good herbage occurs. The best plan of dealing with this weed is to encourage clovers and better grasses by manurial treatment, thus smothering it out by taller and more useful herbage. Fertilizers should include sulphate of ammonia, which may be expected to have a very

beneficial result. Close grazing with cattle and sheep should follow.

Plantains (*Plantago* spp.) are well known to most farmers and gardeners. Three species are very troublesome in grass land :—

The Ribwort Plantain or Rib-grass (*P. lanceolata* L.) is a perennial, having narrow, ribbed, more or less lanceolate leaves, 3 to 12 in. long; tapering rootstock; and short, globose or cylindrical heads at the end of long, angular stalks (Fig. 3). Flowering takes place between May and October. This plantain is known to children under the name of "Cocks and Hens." The brown, shiny seeds somewhat resemble very small date stones, and, although less plentiful, perhaps, than formerly, they are still one of the most common impurities in many kinds of clover and grass seeds. In America this species is known as Buckhorn.

The Broad-leaved Plantain (*P. major* L.), also termed Greater Plantain or Way-bread, is a perennial, having broadly-oblong ribbed leaves on long channelled stalks; a stout truncate rootstock; and minute flowers in very long, slender spikes (Fig. 4). These spikes, when in fruit, are often given to cage birds, which greatly relish them. The writer has by him a spike measuring 19 in. at the end of a stalk 4 in. in length. Flowering occurs between May and September.

The Hoary Plantain or Lamb's Tongue (*P. media* L.) is another perennial, having downy, sub-sessile, broadly elliptical ribbed leaves, with short, flat stalks, the leaves lying very close to the ground (in the two former species the leaves are rather ascending) and destroying all vegetation beneath, leaving a bare patch if the plant be removed. The rootstock is tapering, and the flowers are packed in a close cylindrical spike, shorter than in *P. major*, but on a longer footstalk or stem. The flowers are fragrant, and somewhat conspicuous owing to the lilac bracts; they appear from June to October (Fig. 5).

These three plantains are perennial, and all are common in grass land on practically all soils, although *P. media* is perhaps more frequent on dry calcareous soils. They are a very common trouble in lawns. Where these weeds are very plentiful on a small area they may be spudded out, or be removed with the docking iron, before proceeding to give manurial treatment and arrange close grazing. Rib-grass is frequently included in grass mixtures, perhaps because it will

do well on poor uplands, where in the young stage it may be useful for sheep, and possibly because the roots open up the soil to air and moisture. On the better soils it should not be used for this purpose. Pure seed, free from the seed of plantains, should invariably be sown for leys and permanent pasture.

The general measures recommended for the improvement of grass land should quickly reduce these weeds.

The Wild Onion or Crow Garlic (*Allium vineale* L.) has already received attention in Miscellaneous Publication No. 61 (*Weeds of Arable Land*), in which its life history is fully discussed. The weed also occurs in grass land, where it usurps the place of better herbage, and is otherwise very harmful because it is apt to taint the milk of cows that may be at pasture, and also the butter produced from such milk. On a dairy farm, indeed, a pasture may be rendered almost useless for milking cows owing to the wild onion. It may also badly taint the meat from stock that consume it, unless they are removed to a free pasture for a week or two before slaughter. Sutton says* that the onion-like leaves appear to be very tempting to milch cows, and that "persistent hand-pulling of the bulbous roots early in the year is the only way of ridding pastures of crow garlic." Experiments at Woburn showed that "when the stem is thrown up it is almost impossible to pull the stem and bulb up together. But, as the season advances, the bulb seems to work up to the surface, and about June it is quite easy to pull up stem and bulb together" (Figs. 6 and 7).

This weed is only reduced with the greatest difficulty. Its presence in excessive quantity over a small area may render it advisable to pare and burn the surface soil containing the bulbs, and then re-seed the patches. On a large area it may be best to plough out, take two thoroughly hoed root crops, and re-sow with a heavy grass mixture on the "Elliot" system, which may help to smother the weed. Spraying with a 5 per cent. solution of carbolic acid was long since found at Woburn to reduce the weed, but it is not proved that this treatment is really effective.† When a field is badly infested it may be necessary to consider whether the drainage is effective, and whether a full course of improvement should not be started. Persistent hand-pulling, or even repeated mowing, between spring and autumn, should greatly help to reduce

* Martin J. Sutton : *Permanent and Temporary Pastures*, 1929, p. 145.

† *Jour. Roy. Agric. Soc.*, 1900, 1901 and 1902.

this pernicious weed. Milch cows should not be allowed on the pasture, which should be given up to horses, young stock, fattening beasts and sheep; but care should be taken to change the pasture a fortnight before stock are sold for slaughter.

Ramsons or Broad-leaved Garlic (*Allium ursinum* L.) is a fairly common plant on moist, shady spots, in pastures, as by the sides of streams (Fig. 8). It is 1 to 2 ft. high, with large, flat, broad leaves, resembling those of the lily-of-the-valley. The stems are triangular, and bear a flat-topped umbel of white flowers, which appear in May and June. If crushed, the whole plant emits a strong characteristic smell of garlic. Ramsons is chiefly troublesome where milch cows may eat it, as they frequently do, when the offensive odour and taste characteristic of the plant is communicated to the milk and the dairy produce prepared from it. There is also the danger of meat being tainted. The weed is not likely to occur on extensive areas, and where cattle may get at it the plants should be cut down regularly or the bulbs may be dug out. Temporary change of pasture as may be necessary is also indicated.

Meadow-sweet, Queen of the Meadow (*Spiræa ulmaria* L.), is a tall, handsome perennial, attaining to 4 ft. in height; it sometimes occurs very freely in low-lying, damp meadow land, such as water meadows. Meadow-sweet is herbaceous, with large leaves upwards of a foot long from the base of the plant, interruptedly pinnate, with serrate edges, and white and downy beneath. The flowers, which appear between June and August, are collected in large compound cymes 2 to 6 in. in diameter: each single flower is small, about $\frac{1}{4}$ in. in diameter, white or nearly so, and sweetly fragrant. This species is a favourite among wild plants, is reminiscent of the garden spiræa, and in view of its stately beauty is aptly named Queen of the Meadow.

The only plan of getting rid of an excessive quantity of this tall, stout plant is to mow it regularly, and by drainage, liming, manurial treatment and grazing to encourage more useful herbage, when the weed should soon be much reduced or gradually disappear under progressive improvement of the land.

The Burdock (*Arctium lappa* L.) is an erect branched biennial, often 3 to 4 ft. high, that grows chiefly in waste places, by hedges and ditches, and in damp grass land on calcareous and

clay soils. It has a very stout stem, and large alternate, stalked, heart-shaped and pointed leaves, usually very cottony beneath and frequently a foot long. The roots are strong and deep seated. The small purple flowers appear in July and August, grouped together into globose heads each about 1 in. in diameter; the heads have stiff, spiny, hooked bracts, and readily adhere to the clothing of man or the fur and hair of animals, thus securing their distribution. The name *Arctium* is derived from the Greek *arktos*, a bear, from the rough heads or "burs."

The Burdock (Fig. 9) is spread by seeds, and should therefore be attacked by regular cutting early in the summer as soon as the plants begin to show up well, to prevent seeding. Where it is known to occur the first-year plants, which merely consist of the roots and a large rosette of leaves, should be thoroughly spudded and grubbed out, cutting them off well below the crown. Need for general improvement is indicated if the burdock is plentiful.

The Butter-bur (*Petasites vulgaris* Desf.) is a large, strong-growing perennial that commonly occurs in damp, wet meadows, in low-lying land near streams and rivers, especially on sandy and clayey soils, where it is on occasion a serious pest. It has been described as "the largest, and, where it abounds, the most pernicious of all the weeds which this country produces" (Johns).

The butter-bur has an extensively creeping, fleshy rootstock from which flowering stems are sent up during the early spring months (February to May) before the leaves appear. The flowers are pinkish or dull lilac, in head-like panicles on a short, fleshy stalk. The male and female flowers are usually in different heads. As in the case of coltsfoot, the leaves follow the flowers; they are very large—up to 3 ft. across—resembling those of rhubarb, and borne on long stalks; they are white and cottony beneath. The common name is said to have been derived from the fact that the large leaves were formerly used for the purpose of wrapping up butter, but there are no "burs" on the plant.

This weed must be attacked by cutting down the flowering stems to prevent seeding, and later by persistent cutting of the large leaves to prevent the manufacture and storage of food for the future use of the plants. Cut surfaces after spudding might be treated with a pinch of sulphate of ammonia, sulphate of iron, or sulphate of copper (bluestone). Very small

patches may be grubbed out, but as the root system is extensive and deep seated, this plan is too costly on large areas. Spraying with a 5 per cent. solution of copper sulphate might be tried, as the leaves are so large and rough they would be likely to retain the liquid, but cutting is probably simpler and quicker. Where it can be carried out, drainage is of use. Improvement of the herbage by liming, manurial treatment and grazing should then reduce the weed.

INSTRUCTION IN CLEAN MILK PRODUCTION

1.—Clean Milk Competitions.—The detailed summary in the accompanying table gives particulars of the clean milk competitions commenced in England and Wales during the years ended March 31, 1929, and March 31, 1930, respectively. During the latter year, 35 competitions were commenced, compared with 36 in 1928-29, but the number of competitors was increased from 914 to 965, of whom 497 had not previously entered a competition. Full particulars as to analyses and advisory visits cannot be given for the year 1929-30, as six competitions were still in progress when the returns were made.

The interest of the Trade in the movement was well maintained. Eleven bonus schemes, providing either for cash prizes of stipulated amounts or for bonus payments on a gallonage basis, were operated in conjunction with competitions and, in addition, several trophies were offered in connexion with the county schemes. Donations to the general prize funds of the competitions were also made in many instances.

2.—Advisory Schemes.—In practically every county provision has been made by the County Education Authority for advisory services for dairy farmers. The plan most commonly followed is that in which the conduct of clean milk competitions and milkers' competitions plays an important part, but, in a few counties, departures have been made from the usual set plan by the introduction of special schemes, of which particulars are given below.

(a) *Wiltshire.*—An advisory service for licensed producers of "designated" milk was conducted during 1929, and eighteen producers took part in the scheme. Samples were taken at regular intervals for bacteriological examination, with the object of assisting producers to maintain the required standard ;

Oxford	..	30	1,045	295	178	184	24	8	686	228	155	165	66
Rutland	..	..	..	..	..	..	..	..	..	..	..	..	13
Salop..	..	10	334	50	45	10	18	8	708	88	59	18	39
Shrop..	..	..	..	..	..	..	43§	25	2,104	303	130	43	243
Somerset	..	..	..	..	..	..	..	..	..	..	..	..	20
Staffs	..	..	..	..	..	..	..	..	..	..	..	..	61
Suffolk E. & W.	..	33	886	297	261	132	..	..	..	..	..	..	126
Surrey	..	40	1,369	340	261	160	40	7	1,327	240	149	150	201
Sussex, E.	..	62	1,800	183	117	186	79	38	2,300	317*	170*	160*	111
Sussex, W.	..	24	668	203	111	88	25	17	595	214	96	85	76
Warwick	..	33	1,061	297	223	165	40	17	1,100	360	279	200	164
Wilts..	..	29	1,390	252	166	90	4||	..	183	28	15	12	64
Worcester	..	21	312	189	136	63	23	11	493	207	150	115	64
Yorkshire	..	39	782	468	358	72	39	25	788	468	396	70	133
TOTAL : ENGLAND	..	811	22,913	6,675	4,520	3,224	875	425	24,260	6,430	4,136	2,800	3,244
Anglesey	..	15§	183	79	52	98	20§	15	222	100	72	135	41
Brecon and Radnor	..	14	170	54	33	32	..	..	..	..	..	..	35
Cardigan	..	..	..	..	..	..	..	..	..	..	..	..	26
Caernarvon	..	..	..	..	..	..	..	..	..	..	..	..	33
Carmarvon	..	19	340	114	79	78	..	..	..	..	..	..	19
Deubigh	..	..	..	..	..	..	..	..	..	..	..	..	80
Flint ..	..	13	183	117	81	38	22§	20	330	96*	47*	61*	64
Glamorgan	..	..	..	..	..	..	..	..	..	..	..	..	..
Merioneth	..	15	135	45	27	36	18	13	186	162	116	40	28
Monmouth	..	..	..	..	..	..	..	..	..	..	..	..	..
Montgomery..	..	..	..	..	..	..	..	..	..	..	..	..	18
Pembroke	..	27§	357	161	153	141	30§	24	390	164*	110*	118*	72
TOTAL : WALES	..	103	1,368	570	425	423	90	72	1,128	522	345	354	416
TOTAL : ENGLAND & WALES	..	914	24,281	7,245	4,945	3,647	965	497	25,388	6,952	4,481	3,154	3,660

* Figures incomplete as competitions were still in progress when the return was made.

† Includes Hyde Borough (retail) competitors.

‡ Modified schemes.

§ Two competitions were commenced during the year.

|| Probation section of County Register of Accredited Milk Producers.

where necessary, advisory visits were paid. The scheme was continued on similar lines in 1930.

(b) *Nottinghamshire*.—The system adopted in this county is to co-operate with the local Public Health Department in the conduct of an advisory scheme in a particular area over a period of twelve months. At the time the return was made, two such schemes had been completed and a third was still in operation. The following summary indicates the progress of the movement :—

Period .. .. .	..	..	..	..	<i>Manafield.</i>	<i>Warsop.</i>	<i>Selston & Hucknall.</i>
					1/11/28— 31/10/29	1/4/29— 31/3/30	1/12/29— 30/11/30
No. of producers concerned ..	..				32	20	36
No. of cows in herds ..	..				410	131	699
No. of milk samples examined ..	..				409	249	137
No. of milk samples which reached "designated" standard ..	..				191	91	95
No. of advisory visits ..	..				110	70	80
No. of licences for the production of "designated" milk which have been taken out as a result of the scheme					1 Grade "A"	2 Grade "A"	Scheme still in operation

(c) *Lincs (Kesteven)*.—A continuous advisory service has been introduced in the county for such producers as may wish to take advantage of the facilities offered. The scheme had been in operation only for a few months when the return was made. During this period, 9 producers had been assisted, the number of farm visits involved being 19. A total of 14 milk samples had been submitted for analysis and 7 of these fulfilled the bacteriological requirements for "designated" milk.

(d) *Staffordshire and Lincs (Lindsey)*.—The schemes in these counties are carried out in co-operation with the Public Health Committees, who notify the Education Authority of cases in which unsatisfactory samples of milk have been taken. Advisory visits are then paid by the Agricultural Organizer or a member of his staff. During the year ended March 31 last, 104 advisory visits were undertaken in Staffordshire and 70 in Lindsey.

(e) *Leicestershire*.—A similar scheme to those described in paragraph (d) is carried out by arrangement with the Sanitary Inspectors and the County Branch of the National Farmers' Union. Results of analyses of samples taken by the Inspectors are sent to the Union; the Agricultural Organizer is, in turn, notified of unsatisfactory samples and arranges for an advisory visit to be paid to the farm concerned.

(f) *Montgomery*.—Arrangements have been made for the Sanitary Inspectors to take surprise samples of milk from

producers in their areas. The samples are forwarded to the University College of Wales for analysis, and the results are sent to the County Education Committee, who defray the cost of examination. When an unsatisfactory sample is obtained, the farm concerned is visited by the Dairy Instructress with the object of introducing improvements. During the year 1929-30, 150 samples were submitted for analysis and 50 advisory visits were made. The Committee is satisfied with the great improvement in cleanliness that has been secured through the scheme.

3.—County Registers of Accredited Milk Producers.—This scheme must still be regarded as only in the experimental stage. Following the experience in Wiltshire in 1929, four other counties put the scheme into operation in 1930. The main objects of the scheme are (1) to provide facilities by means of which those who have attained proficiency in a clean milk competition may receive regular assistance in maintaining a high standard of production; and (2) to provide a basis on which a system of bonus payments for milk of high hygienic quality may be established.

The conditions governing the scheme are, broadly, as follows :—

(1) In order to be eligible for registration, a producer shall have attained a satisfactory standard of production (a) in a county clean milk competition of six months' duration or (b) in the course of a probationary period of six months, during which time milk samples have been tested and farm inspections carried out on the same conditions as obtain in a clean milk competition.

(2) Monthly milk samples shall be submitted for bacteriological examination, and shall be expected to conform with definite requirements in respect of bacteriological content. In cases where three consecutive monthly samples fail to conform with these requirements, the producer concerned may be either suspended or removed from the register.

(3) The milk samples shall be tested also for butter-fat in order to detect abnormal sampling and to obtain the necessary information in connexion with any bonus schemes which may provide for extra payments in respect of fat content.

The only complete report on the scheme is in respect of Wiltshire for the year 1929. Eighteen producers were registered and two withdrew during the course of the year. A probationary section of the Register was introduced in this county in 1930, and all four producers who participated qualified for registration.

4.—Milkers' Competitions.—The following summary indicates the increased interest which is being taken in this method of instruction :—

	1928/29	1929/30
No. of competitions organized	66	76
No. of competitors	1,084	1,507
No. of competitors who reached proficiency standard	898	1,243

MARKETING NOTES

National Mark Eggs.—The scheme for the sale of eggs under the National Mark continues to make satisfactory progress, and the total output of packing stations for the year 1930, amounting to no less than 221 million eggs, of which 158 million were packed under National Mark labels, shows that this scheme is becoming a well-established and successful feature of the poultry industry in this country, and is receiving steadily increasing support from poultry keepers. During the five months August—December, the output of the stations was 75 million eggs, of which 55 million were packed under the Mark, these quantities being greater than those for the corresponding months of last year by 25 per cent. and 39 per cent., respectively. The steadily growing demand for National Mark supplies has enabled these increased quantities to find a ready market. Probably as a consequence of a 30 per cent. increase in imports from Australia and South Africa, and of somewhat milder weather, compared with the previous year, the seasonal decline in prices which usually sets in during the late autumn occurred somewhat earlier in the season than was expected, and the market consequently displayed a quiet tendency, especially during the period immediately previous to Christmas.

A copy of the annual report and balance sheet for the year ended September 30, 1930, has recently been received from the Norfolk Egg Producers, Ltd., one of the largest co-operative egg-packing stations operating the National Mark Scheme. This shows that, on a turnover of over £50,000, a net profit of more than £1,000 was made, which allowed of the payment of a bonus to members of 3d. in the £ based on purchases from them during the two years immediately preceding the issue of the account. In spite of the fact that the station is situated in an important egg-producing area, and is purchasing its supplies in competition with all classes of egg merchants, its membership and turnover of eggs have nearly doubled during

the 12 months. These developments, coupled with the payment of the bonus to members, are indicative of the success which attends efficient co-operation as exemplified by this society.

National Mark Beef.—The weekly average number of sides (including quarters and pieces expressed in terms of sides) of beef graded and marked with the National Mark during December, 1929, and December, 1930, and the number of sides graded and marked for the five weeks ended January 17, 1931, were as follows :—

LONDON				<i>Number of Sides</i>
Weekly average	..	December, 1929	..	1,198
" "	..	" 1930	..	2,503
Week ended	..	December 20, 1930	..	4,154
" "	..	" 27, 1930	..	1,325
" "	..	January 3, 1931	..	1,692
" "	..	" 10, 1931	..	2,145
" "	..	" 17, 1931	..	1,983

BIRKENHEAD*				
Weekly average	..	December, 1929	..	254
" "	..	" 1930	..	836
Week ended	..	December 20, 1930	..	741
" "	..	" 27, 1930	..	754
" "	..	January 3, 1931	..	785
" "	..	" 10, 1931	..	957
" "	..	" 17, 1931	..	820

SCOTLAND*				
Weekly average	..	December, 1929	..	1,371
" "	..	" 1930	..	2,499
Week ended	..	December 20, 1930	..	3,455
" "	..	" 27, 1930	..	1,654
" "	..	January 3, 1931	..	1,912
" "	..	" 10, 1931	..	2,337
" "	..	" 17, 1931	..	2,594

TOTAL LONDON SUPPLIES (All sources)				
Weekly average	..	December, 1929	..	2,823
" "	..	" 1930	..	5,838
Week ended	..	December 20, 1930	..	8,350
" "	..	" 27, 1930	..	3,733
" "	..	January 3, 1931	..	4,389
" "	..	" 10, 1931	..	5,437
" "	..	" 17, 1931	..	5,397

BIRMINGHAM				
Weekly average	..	December, 1929	..	442
" "	..	" 1930	..	487
Week ended	..	December 20, 1930	..	678
" "	..	" 27, 1930	..	277
" "	..	January 3, 1931	..	342
" "	..	" 10, 1931	..	493
" "	..	" 17, 1931	..	460

* Sides consigned to London.

During December, 1930, there was a striking increase in the number of sides of home and Scotch-killed beef that were graded and marked for London, the total being 25,852 sides, which is the highest number graded and marked in any one month since the commencement of the scheme. The totals for the weeks ended December 13 and 20 were also the record figures of 5,759 and 8,350, respectively. The number of sides graded and marked at Birmingham has continued to show satisfactory improvement since last October.

An increasing number of direct consignments of cattle is being sent from farms to the Islington abattoir for sale on a grade and dead-weight basis under the Ministry's experimental scheme. The prices obtained for the cattle have given general satisfaction, and it is hoped that more farmers will take advantage of this system of sale. A leaflet (Marketing Leaflet No. 27) explaining the scheme is being printed, and copies may be obtained, free of charge, from the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.

National Mark Strawberries.—It may be useful to review the first season's working of this scheme. When the formulation of the strawberry scheme for the season 1930 was mooted, the majority of those possessing knowledge of the strawberry industry expressed the opinion that the application of the National Mark scheme to this fruit was impossible. In spite of this mass of adverse opinion, a survey of the strawberry areas was made, and the possibilities of the scheme were discussed with growers at a large number of meetings. In the course of this survey, it became evident that there was a strong movement amongst strawberry growers towards precise grading, coupled with guaranteed net weights of packages, and that many growers were, in fact, grading and packing to standards approximating to those proposed in the scheme. The revelation of this movement at meetings was often a surprise to the growers themselves.

The insistent demand of the retail section of the distributive trade for guaranteed net weights and the abolition of topping, together with the definite knowledge of the shortcomings of growers in their methods of marketing strawberries, were important factors in reaching the decision to proceed with the National Mark scheme.

Before the scheme was launched, it was realized by all concerned that it bristled with difficulties, some of which were

almost insurmountable. Because of this, it was made known quite plainly that the scheme was experimental.

The fact that strawberries must be graded at the time of picking, and that the strict control of hired pickers was almost impossible in present conditions, ruled out a very large acreage of fruit at the start. It was clear, nevertheless, that a large number of growers of small acreage were able and anxious to join any reasonable scheme which aimed at better methods of marketing. It is well known that not only can small growers exercise better control over grading and picking operations than large growers but they can usually grow quite as good quality fruit as the producers. Because of this, the acreage qualification was fixed low enough to bring in the smallest commercial growers.

To meet the difficulties of grading, the standards were fixed very low. The main grade, "Selected," means little more than the culling of dirty, damaged, and undersized fruits; practically, it means the crop as picked. To meet a limited demand for berries of superlative quality and size with uniformity of colour, the grade "Extra Selected" has been established.

Authorized Packers.—Before the opening of the season, the scheme was explained to strawberry growers at fourteen meetings and a large number of individual growers were visited. As a result, 94 enrolled in the Scheme. All were advised to pack under the Mark only that portion of the crop which they could ensure would be correctly graded and packed.

Quantity Marketed.—No actual figures as to the quantity marketed under the Mark are available, but it is obvious that it amounted to only a very small proportion of the total output. In the Cheddar area, prolonged drought resulted in a light crop of small berries, and several registered growers were unable to pack even to the very low standards provided. In the Hampshire area, the crop lasted for an unusually short period and berries at the finish were small. In a large part of the Wisbech area, hail and very heavy rain ruined as much as 25 per cent. of the fruit. Delay in delivery of covers also prevented several growers from using the Mark until a part of their crop had been marketed. As indicated elsewhere in this report, the demand far exceeded the supply.

Distribution.—In spite of the small quantity marketed, distribution was more widespread than with any other National Mark fruit. Consignments went to almost all of the larger towns in Great Britain.

Inspection.—The widespread distribution and the speed with which this crop must be handled made market inspection a matter of difficulty. In Covent Garden, as well as in the provincial markets, National Mark strawberries were almost invariably sold out within a few minutes of arrival. Inspection brought to light no complaints other than that of damage due to the use of undersize chip baskets, nor have retailers, through their associations, reported any cause of dissatisfaction. Their only complaint was that supplies were too small.

Grading.—Those growers who have full control of their pickers do not appear to have experienced any difficulty in grading to the standards laid down.

Some growers appeared to think that it was compulsory to make two grades although the regulations distinctly state otherwise. Unless the crop is especially good and a salesman who has a connexion for high-grade fruit is employed, the grower will most probably incur a loss by making two grades. With the average grower it is better to pack "Extra selected" and "Selected" berries together as "Selected."

Packages.—As growers had on hand stocks of chip baskets which differed slightly in dimensions from the standards laid down, permission was given for these to be used provided that they contained the specified net weights. This concession resulted in a considerable amount of damage to fruits, but it has been a valuable object lesson in demonstrating to all sections of the industry: (1) that a large proportion of the chip baskets used will not safely hold the weight they are supposed to hold; and (2) that a very large proportion of the baskets marketed are short in respect of the purported weight of the fruit.

It is hoped that a greater measure of uniformity as regards packages, will be achieved next season and that baskets which are satisfactory in respect of capacity will be generally used for National Mark strawberries.

Covers.—There has been much controversy and criticism regarding the National Mark covers, both before and since the scheme became operative. Different growers hold differing views as to the most satisfactory type of cover, but it must again be emphasized that standardization is the essence of the National Mark Scheme and it was necessary to devise one type of cover that would raise the least amount of objection generally. In spite of criticism, the cover provided seems to have served the purpose quite well. It is probable, however, that a thin pulp-board cover of the same type would serve the purpose better, but at present this appears to be too costly. There has also been some criticism of the colour of the "Selected" grade cover as being liable to detract from the colour effect of the berries, but this point, with the others, will be carefully taken into consideration when a reprint of the covers is required.

Effect of the Scheme.—That the experiment of the strawberry scheme has been justified there can be no possible doubt. Short weights and "topping" had become so common and of such long standing that both salesmen and buyers had come to regard them as inevitable, and a state of almost complete apathy existed. Propaganda before the scheme opened aroused renewed interest in this problem, and finally the incursion on the markets of National Mark strawberries generated, by example and contrast, increased activity towards ending the "topping" and short-weight evils.

As far as it has been possible to trace, growers packing under the Mark seem to have secured more profitable returns through the use of the Mark. From general observation, it would appear that there is a large demand for strawberries of high quality. A substantial number of consumers are prepared to pay good prices for good quality supplies, but will not buy inferior quality at any price. The National Mark Strawberry Scheme can render invaluable assistance to growers who are willing to make an effort to satisfy this demand.

The market value of different varieties of strawberries is a matter which the scheme has brought into prominence. It is held by many growers, salesmen and retailers that the indifferent edible quality of certain varieties is damaging the consumer-demand for strawberries, and it is freely suggested that these varieties should be excluded from the scheme. This question is under consideration.

Revision of Regulations.—The definitions of grades and sizes of berries appear to meet with general approval, but so many criticisms in connexion with covers, packages and varieties have

been made that it may be desirable before next season to hold a conference of those interested in the strawberry industry for the purpose of discussing the application of the scheme in all its aspects. This matter is receiving the attention of the Ministry.

National Mark Cherries.—In reviewing the first season's working of the National Mark Scheme for cherries, it must be borne in mind that the small number of growers who were able to register during the first season, and the small quantity of cherries marketed under the Mark, do not provide much material for report.

When the scheme came into operation and growers were canvassed for registration, the season was already well advanced. Crops were exceptionally heavy and some of the mid-season and late varieties were ripening rapidly at the same time. In many cases, growers had great difficulty in obtaining suitable pickers, and the general opinion was that for the season 1930 it was too late to instruct pickers in grading and to obtain National Mark packages and overprinted labels. In the circumstances this was a reasonable attitude, and it is satisfactory to be able to report the enrolment of 10 packers in this trial season. There is no doubt that in normal conditions many more growers would have enrolled.

Adverse Factors.—In the Sittingbourne and Faversham districts of Kent, difficulties in respect of picking-labour appear to have been most acute, many growers having to rely upon overtime labour from the local brickfields for early morning and late evening picking. In order to avoid losing many tons of cherries, they were obliged to clear the trees as fast as possible, regardless of grading. Prices were satisfactory for the many thousands of ordinarily packed half-sieves that were being loaded daily, and the statement of many growers that they could not, under the prevailing conditions, properly supervise grading and packing was to some extent true. It was explained to them, however, that, in spite of the rush they were experiencing in getting the heavy crops gathered, they could market their half-sieves under "Selected" grade, which meant only the additional labour of tying on the National Mark label. They feared, however, that their salesmen would at once think that, if receiving National Mark "Selected" grade only, the "Extra Selected" were going to other salesmen. Another difficulty in regard to picking-labour in some of the Kent districts is that the dealers who buy orchards at auctions generally collect most of the best pickers by offering a higher wage.

The established custom of many growers in Kent of selling their cherry crops on the trees by auction can hardly be of much benefit to the scheme. As the result of these auctions, the fruit is bought, picked and marketed by fruiterers and dealers. Their methods are usually very rough. The greater portion of the cherries sold by these men goes direct to retailers in the coast towns—a method of quick sale with little expense which undoubtedly suits their purpose. It is not likely that many of these dealers will become National Mark packers.

General Observations and Recommendations.—For the purpose of obtaining observations upon the scheme, the authorized packers were

re-visited at the close of the cherry season. Although packers felt that they had seen too little of the scheme during the first season to say much about it, the following points have been put forward for consideration :—

- (a) *Statutory Definitions of Quality*.—One important Kentish grower considers that the minimum sizes of $\frac{3}{4}$ in. and $\frac{1}{2}$ in. for the two grades, respectively, might be raised, or, as an alternative, minimum sizes for individual varieties might be laid down. It is realized that to set up size standards for the large and small varieties would tend to make the scheme complicated, but large varieties, such as "Rivers," "Roundells" and "Napoleons," certainly appear to merit special size standards, although, as some of the largest cherries in the country are grown in the Kentish district, the raising of the minimum size for certain varieties might exclude from the scheme packers in other parts who do not grow such large-size fruit. It must be remembered that the requirements of "Selected" grade represent little more than is done by the ordinary packer, i.e., culling for blemish in transferring the fruit from picking receptacles to the market packages.

The recommendation is made, therefore, that, for the season 1931, the grade definitions should remain as at present, but that during the next cherry season the practicability of setting up minimum sizes for certain varieties should be carefully investigated with the object of a possible separation of the main commercial varieties into two classes.

- (b) *Packages*.—One packer who specializes in 6-lb. boxes of high quality "Napoleons" has suggested that 6-lb. packages should be permitted for "Extra Selected" grade. Other packers would like the 4-lb. chip to be included for "Extra Selected" grade, and it is recommended that this package, together with the 3-lb. chip, should be included in the scheme for this grade.

The 6-lb. box is not considered necessary for "Extra Selected" grade. It is a well-known fact that in the course of distribution small boxes are frequently thrown about, but chip baskets—having handles—are generally treated more kindly.

The fact that there is an increasing tendency on the part of cherry growers to disregard returnable wicker packages in favour of chips and other small non-returnables promises well for the future. Prices for best-quality cherries in chips have been highly satisfactory. Although, in some instances, growers, in turning to chip baskets after years of packing in wickers, have been returned the same price per lb. whatever the package, and have also been asked by their salesmen not to send chips, most of these growers intend to persevere with the chip package.

National Mark Apples and Pears.—Further authorizations in the apple and pear scheme have brought the number of packers up to 96 for apples and 18 for pears, compared with 71 and 9, respectively, a year ago.

The large demand for National Mark apples has again been greater than the supply, and uniformly good prices have been received throughout the season.

National Mark Canned Fruit, Peas and Beans.—The Ministry has been informed by a firm of distributors acting as export agents for an authorized canner that they are sending National

Mark canned fruit to India. A supply of display material for use in connexion with this overseas trade has been sent to the firm concerned.

National Mark Wheat Flour.—In view of the fears expressed regarding the quality of National Mark wheat flour derived from the 1930 crop, it is gratifying to find that, as a result of extended baking tests, National Mark "Yeoman" flour made from wheat harvested in 1930 possesses more uniform baking qualities and greater strength than that from the crop of 1929, and that it is capable of carrying half-a-gallon more water to the sack.

Comparison of the analyses of the flour from the 1929 and 1930 crops shows that, while the ash content is lower this year, the moisture-content, owing to the nature of the season, is naturally somewhat higher. The actual figures are :—

	1929 crop (154 samples)	1930 crop (41 samples)
Average ash content	0.51 per cent.	0.49 per cent.
Average moisture content . .	14.33 per cent.	14.81 per cent.

From the miller's point of view, more care must be taken this year in selecting wheat intended for milling National Mark flour, but, subject to this provision, there is every prospect that the high uniform quality of National Mark flour will be maintained.

The following additional firms have been enrolled in the Scheme as authorized re-packers :—

Glendale Co-operative Society, Ltd, Wooler, Northumberland.
Hasler & Co., Ltd., Dunmow, Essex.

Publicity for National Mark Produce.—In connexion with the Ministry's National Mark exhibit at the Birmingham and Midlands Grocers' and Bakers' Exhibition at Bingley Hall, Birmingham, January 13-24—reference to which is made below—hoarding posters advertising National Mark beef, dressed poultry, eggs, flour, apples, canned fruits, canned peas and beans, and malt extract with cod liver oil were displayed in Birmingham and district for four weeks in January, and special advertisements were inserted in the local papers.

Following the advertising in London up to the end of December, by means of side streamers on the omnibuses, of National Mark beef, canned fruits, canned peas, and malt extract with cod liver oil, a further contract has been arranged, covering the first three months of 1931, for National Mark beef, eggs, and canned fruits to be advertised in a similar manner. One firm of canners has already followed the Ministry's

lead and arranged for 'bus advertisements of their own brand of National Mark canned fruit, and it is understood that another large firm of canners has been so impressed with the merits of this form of publicity that they are proposing to make similar arrangements.

Extensive publicity has been arranged in connexion with the inauguration of the National Mark Beef Scheme in Leeds, Bradford and Halifax on January 26. As part of the preliminary propaganda, two meetings were held on January 12 in Leeds and Bradford, over which the respective Lord Mayors presided. Over 500 persons attended the meeting in the Town Hall, Leeds, including a large number of meat traders, when the National Mark Beef Scheme was explained by Earl De La Warr, Parliamentary Secretary to the Ministry, supported by Mr. W. Lunn, M.P., Vice-Chairman of the Empire Marketing Board, and Mr. G. H. Collinge, O.B.E., a past-President of the National Federation of Meat Traders' Associations.

Lord De La Warr was supported on the platform by a number of local Members of Parliament, together with other leading citizens of the area. The speakers received a very sympathetic hearing from the audience, and the questions which followed were in no sense of a hostile nature. The meeting concluded with a short display of National Mark films.

At the evening meeting at Bradford, which was also addressed by Earl De La Warr and Mr. Collinge, the audience numbered some 400, and, from the large number of questions, it was evident that the proposed introduction of the scheme was arousing a keen interest in the locality. As at Leeds, a short film display concluded the meeting.

A further meeting for women only was held at the Rialto Cinema, Leeds, on January 22, when the programme consisted of a display of Empire Marketing Board film, and of the Ministry's National Mark films, together with speeches during the interval by Lady Cynthia Mosley, M.P.

In addition to this form of propaganda, a programme of Press advertising has been commenced in the newspapers circulating in Leeds, Bradford and Halifax, while the display of a special 16-sheet National Mark beef poster has been arranged on a large number of hoardings in those towns.

Reference was made in the December issue of this JOURNAL (p. 914) to the National Mark Flour Cookery Competition, arranged under the joint auspices of the Ministry and the

National Federation of Women's Institutes. The following fourteen County Federations have so far intimated that they have decided to hold county competitions—Montgomery, Oxford, Lancashire, Isle of Wight, East Suffolk, Cumberland, Monmouth, Cornwall, Shropshire, East Sussex, West Sussex, Stafford, Huntingdon, and Somerset.

The second edition of the booklet, "The National Mark," printed in July, 1930, has been widely circulated, over 500,000 copies having been distributed in a little over six months. Copies of the booklet may be obtained, free of charge, on application to the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W.1.

An instance of what can be done by interested organizations to augment the efforts of the Ministry to stimulate the demand for National Mark commodities, especially among producers, is afforded by the plan which the Isle of Ely Branch of the National Farmers' Union has adopted to advertise National Mark flour in its area. It has issued to its members, for use on their correspondence, supplies of an attractive adhesive stamp, bearing the National Mark and the words: "Buy National Mark Flour and All-English Bread and Support Home Agriculture."

The farmers of this important producing area are to be congratulated on their initiative, which should result in an increasing local demand for National Mark flour.

Displays of Home Produce.—From January 13-24, a display of National Mark produce was staged at the Birmingham Grocers', &c., Exhibition, held in Bingley Hall. This is being followed by a fortnight's display of home produce by the Ministry at shop premises in Birmingham, rented by the Empire Marketing Board for the purposes of the display and sale of samples, in turn, of the produce of the United Kingdom and of the various Dominions and Colonies.

At an Exhibition of the English Folk Cookery Association, held at the Lecture Hall of the Gas Light and Coke Company, Church Street, Kensington, on January 16, National Mark produce was displayed, including National Mark flour, eggs, canned fruits and vegetables, beef and poultry. A feature of the display was a variety of loaves, cakes, buns, pastry, etc., made from National Mark flour.

Iowa: A "National Mark" for Butter.—In last month's issue of this JOURNAL, reference was made to the marking or labelling schemes for agricultural products which have been

introduced by some of the American States, following the establishment of statutory grades for the products raised in their areas; and a description was given of one of these schemes—the New England Farm Marketing Programme.

Another scheme—which resembles, in many respects, the National Mark schemes in this country—is the Iowa butter-marking scheme, described below.

Iowa is one of the leading butter-producing states in the U.S.A., being second only to Minnesota in the quantity produced. Not all parts of Iowa are suited to the production of the best quality butter, however, and there was a feeling that the sale of Iowa butter in the Eastern States was being prejudiced by the inferior qualities that were being put on the market. The need for some means of identifying and guaranteeing high quality led to a demand for a State brand.

Accordingly, in 1927, the State Assembly passed a law, the purpose of which was “to promote educational work which will assist Iowa butter-makers in producing butter to be marketed under a State trade-mark and thereby ensure a more uniform market and higher market value for the butter manufactured in the State.”

A State trade-mark was adopted (reproduced opposite), the use of which was to be restricted to creameries that agreed to conform to certain rules. Among these rules, the following may be quoted:—

All the creameries must fulfil certain sanitary requirements.

Of the butter produced in the creameries, at least 75 per cent. must score, on quality, not less than 93 points. A creamery obtaining less than 93 points, or having more than 25 per cent. of its scoring below 93, forfeits the right to use the trade-mark.

The butter must contain not less than 80 per cent. of butter-fat and not more than 16 per cent. moisture.

No preservative, neutralizer, or adulterant may be added to the butter or to the cream from which it is made.

The cream or milk used in the manufacture of the butter must have been pasteurized.

Upon the request of the Executive Committee in charge of the scheme, a creamery must send butter from its most recent churning for the purposes of scoring to such places and in such quantities as designated by the Executive Committee.

Violation of any of the rules is a misdemeanour rendering guilty parties liable to a fine of not less than \$25 or more than \$100, or imprisonment for not less than 30 days.

There are, at present, about 30 State Brand Creameries in Iowa, producing, in the aggregate, 9,000,000 lb. of butter annually, as well as over 500,000 lb. of sweet cream. The

average price received for butter by the patrons of these creameries appears to have been between 15 cents and 45 cents above that of other creamery patrons in the State. It is interesting to note that 15 of these creameries have formed a central organization for the sale of their products on the markets.



Trade Mark adopted for First Quality Iowa Butter.

Loans to Co-operative Marketing Enterprises.—Since 1924, provision has been made annually by Parliament to enable the Ministry to make loans to agricultural co-operative enterprises registered under the Industrial and Provident Societies Acts and engaged, or proposing to engage, in the preparation and marketing of agricultural produce. These loans, for which security is required, are normally made for the acquisition of land, buildings, machinery, plant and equipment.

Loans are made for periods up to 20 years, repayable by half-yearly instalments, and interest is charged at 5 per cent. per annum. In certain circumstances, a loan may be made free of liability for interest for an initial period up to five years. Repayment of capital may, in certain circumstances, be deferred for a period not exceeding two years.

Each application for a loan is considered by an Advisory Committee. On the recommendation of that body, the following loans, amounting in all to £50,170, have been granted to the undermentioned 13 societies since the scheme was instituted :—

<i>Year</i>	<i>Name of Society</i>	<i>Amount of Loan £</i>	<i>Period</i>	<i>Remarks</i>
1924	East Grinstead & District Producers, Ltd.	120	7 years	—
	Co-operative Poultry Products, Ltd.	5,800	15 years	Loan repaid in full on liquidation of Society.
1925	Farmers' Milk Depot	2,050	17 years	Loan repaid in full.
	Four Crosses, Ltd.			
	Southern Wool Growers, Ltd.	3,500	12 years	In addition to normal repayments, £715 was repaid, August, 1928, on sale of part of security.
	Horeham Road Co-operative Society, Ltd.	1,000	17 years	Loan repaid in full on sale of security.
	Oxfordshire Farmers' Bacon Factory, Ltd.	7,500	17 years	Loss to public funds on liquidation of Society, £1,136.
	Lincolnshire Co-operative Bacon Factory, Ltd.	1,500	12 years	Loss to public funds on liquidation of Society, £1,167.
	Kent, Surrey & Sussex Farmers' Bacon Factory, Ltd.	10,000	17 years	Loss to public funds on liquidation of Society, £7,831.
	Cottenham Growers, Ltd.	200	10 years	In voluntary liquidation.
1927	Yorkshire Farmers' Bacon Factory, Ltd.	10,000	20 years	—
1928	Derbyshire Farmers, Ltd.	3,000	15 years	In addition to normal repayments, £162 was repaid, April, 1929, on sale of part of security.
	Gloucestershire Marketing Society, Ltd.	1,500	17 years	£500 repaid, October, 1930.
1929	Berks, Bucks & Oxon Farmers, Ltd.	4,000	20 years	—

During 1930, the Advisory Committee considered applications for loans submitted by two societies, and on the Committee's recommendation the Ministry has recently offered them loans amounting to £5,328.

Since the inception of the scheme, four further loans, amounting in all to £9,200, have been offered by the Ministry to four societies, three of which were dairying societies, but the societies were unable to comply with the conditions attaching to the loans which, therefore, were not paid over.

Full particulars as to the terms and conditions under which

loans may be made are given in Marketing Leaflet No. 19, copies of which may be obtained, post free, from the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W.1.

Organization of Marketing.—The following appears in the editorial notes in the December issue of *Agricultural Business*, which is published by the Welsh Agricultural Organization Society and the Department of Agricultural Economics, University College of Wales :—

The greatest assistance in improvement of farming and of standards of living is now to be obtained through marketing organizations ; and until marketing is better organized little improvement can be expected. If cleaner milk or a higher butter-fat content is desired—not wholly or necessarily in the consumers' interest—the best way to secure it is through a farmers' organization handling milk and paying on bacterial count and butter-fat standard. When evening out of the milk supply and the dissipation of seasonal surplus are required, there is no better way than through a farmers' selling organization. The difficulties of a seasonal egg supply are best explained to farmers by an agency selling on their behalf. Meat animals fitted to the market demands would be sooner in general supply if a greater part of the marketing process was under farmers' control. When farmers begin to consider market demands, they must begin to consider their fundamental technical methods in relation to the methods of producing to meet the demand. Better grassland management, more and better manuring, better rationing and feeding, better breeding and rearing are paid for only through the markets for livestock and their produce. Blind production pays only by chance. Organized marketing is bound to lead to organized production and the improvement of methods.

Organized marketing is now the best road to better farming. When a farmers' organization faces the markets it is able to tell farmers what is required, and if necessary it can tell effectively and cheaply how to set about producing the required type or quality. With the farmers' organization and its members there is no division of interest such as exists between the farmer and the dealer. The member is interested in getting the best market ; the organization in offering the best product, and by joint action the common need is served. The farmer accepts advice and direction from his own organization more willingly and quickly than from any other source. There are numerous examples of this effect of farmers' marketing organizations, but the principle is so clear that it scarcely needs demonstration. No other way offers such great and reliable possibilities of improving farming as the supply of advice through farmers' own organizations. Breeding, selection, feeding, general management, have all been affected for good in this way.

Better farming depends on sound marketing before its objects can be reached. Better marketing has as its objective the improvement of financial returns, but this is often dependent upon an almost equal improvement in actual farming. But neither farming nor marketing are ends in themselves ; their object is the increase in financial returns for the provision of a better standard of living. The shortest avenue to a better standard of living on Welsh farms is now to be found through the improvement of marketing organization and processes and linking these with the processes of farming under the direction of bodies controlled by agriculturists and working in their interests.

Organized Marketing : A Scottish Opinion.—In the course of a wireless talk given recently, Mr. Joseph Duncan, Secretary of the Scottish Farm Servants' Union, said :—

"In the past, the farm as a separate unit has occupied the foreground, and all our effort has been to improve production on the farm. It is from that position that we have viewed the industry. I suggest that, without losing sight of the farm, we have to think first of the market and work from that angle. It is on the market that revolutionary changes are taking place, to which the farm will have to adjust itself if it is to continue.

"These changes have been developing for some time, but the pace is rapidly increasing. The principal causes are the development of mechanized grain growing and handling in America, in Australia and in Russia. Wheat does not bulk largely in Scotland, but it affects the price of other grains. In oats and barley, we have to face increasing competition while at the same time the market is steadily shrinking through the increase of motor traction, and we have to adjust our agriculture to that fact. When we turn to milk and dairy products, we are faced with increasing supplies of high quality products from the Continent and from the Dominions. The recent developments in refrigeration will lead to an improvement in the quality of overseas meat supplies, which may become formidable competitors in the meat market.

"The developments in the retail distributive trade are all in favour of our overseas competitors and against the individual marketing on which our agriculture is run. Our overseas competitors must grade and bulk their produce because they have to send it long distances. The co-operative distributive societies and multiple firms, buying in large quantities, find it easier to get what they require from the importers. Until British farmers can enter the market in the same way they will find the buyers will continue to go past them.

"Other factors enter in besides grade and bulk, but it is the greatest mistake to imagine that price is the determining factor. Great Britain is not the market for the cheapest farm produce ; it is the market for the best. It buys far more of the higher priced foodstuffs than of the lower. It is distinctly a quality market and will pay the price for the best.

"Even in the market which is free from foreign competition—the liquid milk market—we find the same development going on in Scotland. The large co-operative distributive societies are securing an increasing share of the retail trade, while the merging of wholesalers is going on steadily. The individual farmer is in a hopelessly weak position when he goes to sell milk in such a market.

"Agriculture will have to develop a marketing organization to meet the new conditions, or submit to the conditions imposed by the distributors. It is not that the distributive trades have any animus against our own farmers. They will drive the best bargain they can whomever they buy from, just as the farmers will, whomever they sell to, but there is no reason to suppose that they would rather sell Danish bacon or New Zealand butter than equally suitable produce from our own farms. They will buy what they can sell to their customers. The customers have no prejudice against home produce.

"The market must be studied, and continuously studied, and it must be stimulated to buy home produce. The farmer cannot, of course, follow the turns of the market. That is a job for the specialist. If the farmers are alive to the requirements of the new situation, the specialists will be their servants ; if they neglect their opportunities they will become the servants of the distributors.

"I am not offering organized marketing as a panacea for all the

ills of agriculture. All that I am suggesting is that as the market changes we have to adjust our methods and our thinking to the new conditions. The old problems will remain of what to produce and how to produce it. Organization will not guarantee us a market, but it will enable us to understand it better. It will not guarantee a price. The market will continue to change, new competitors will appear, and the old problems remain in a new setting. All I am suggesting is that we shall be better able to meet them if we rely on team work."

The International Commission of Agriculture and Organization of Marketing.—The International Commission of Agriculture, at its meeting at Antwerp in August last, adopted the following resolution :—

"The International Commission of Agriculture recommends Governments and peoples to bear in mind that in both exporting and importing countries the basic condition—which must be satisfied if the crisis is to be overcome not only in agriculture, but also in industry, trade and commerce—is an equitable increase in the prices of agricultural products.

"It recommends agriculture to seek the solution of the price problem in the creation of national selling organizations, which will be an indispensable preliminary to the achievement of international agreements."

Germany : Rationalization of Dairies.—By the recent opening of a new milk "Centrale" belonging to the Bayerische Milchversorgungsgesellschaft at Nürnberg, the mass movement in the dairy industry in Bavaria has progressed a stage further. The new plant cost some £171,500 to build, is said to be the largest of its kind in Europe, and is capable of dealing with from 33,000 to 40,000 gallons of milk daily. In the butter-making section, 18 cwt. of butter can be made and packed in an hour without being handled. There are also sections for making cheese, dried milk and "Yoghurt." Within the new building, space has also been provided for offices and store-rooms of such kindred enterprises as the Bavarian "Mark" Butter Sales Co-operative Society.

The organization is, to a large extent, a joint municipal undertaking, 45 per cent. of the shares being held by Nürnberg, 12 per cent. by Fürth and 3 per cent. by Regensburg, the remaining 40 per cent. of the shares being held by agricultural interests to the extent of 25 per cent. and the distributing trade 15 per cent. It already operates 100 collecting stations, 620 distributing centres, and supplies 1,200 wholesale distributors, and one result of its activities is that the number of milk retailers in Nürnberg has been reduced from 1,300 to 480.

American Marketing Policy.—In the course of an address to the National Association of Marketing Officials in Chicago, appealing for the support and co-operation of every agency and individual interested in the permanent betterment of agriculture, Mr. Alex Legge, Chairman of the Federal Farm Board of America, said, according to the official press release :—

" A long-time constructive programme for agricultural marketing involves three principles—first, to produce that quality of product which can retain its position against the same commodity produced elsewhere or against the substitution of something else ; second, to endeavour to produce the quantity for which there is a potential buying demand at remunerative prices ; third, so to improve the marketing process that the producer may obtain for his product what it is reasonably worth.

" All of this does not necessarily involve an increase in the price level to the consumer. Distributing costs and the present system of merchandising pretty nearly everything, and the service that the consuming public demands, leave a broad field of possibilities for better returns to the producer derived from economies and improved practices for getting their product to the consumers. In a condition where only 39 cents of the consumer's dollar for bread can be traced farther back than the baker (in other words, 61 cents of the dollar is absorbed in the process of baking and distributing the product, 39 cents covering the allowances for grower, miller and transportation), it does not follow that an increase in the price of wheat need necessarily increase the cost of the loaf of bread.

" As long as you have ten or a dozen different milk wagons tramping the streets and alleys of the city delivering small packages of products to various consumers located in the same building, there are possibilities of a gain at both ends of the line, and this has been demonstrated in a sufficient number of cases to prove rather conclusively that it can be done. As long as it costs more to get a little package of fruit from the railroad car in the Chicago yards to the consumer's table than the entire cost of producing and packing and hauling it a distance of over two thousand miles to town, there certainly remains ample opportunity for betterment.

" And this leads me to a final thought to which I invite your attention. It is this : after many years' study and consideration of the ills of agriculture, the cause behind them and various proposals for their correction, the Congress, in the Agricultural Marketing Act, recognized the problem of the rehabilitation of agriculture as a national one, and declared it to be the public policy of the Government of the United States to assist in the establishment and development of a producer-owned and controlled co-operative system for marketing agricultural commodities "

South Africa : Export Bounties on Butter and Cheese.—A short summary of the provisions of the Dairy Industry Control Act, 1930, was given in this JOURNAL for October, 1930. The Act made provision whereby the Dairy Industry Control Board, which was incorporated under the Act, could impose a levy on all butter, butter substitutes and cheese manufactured in or imported into the Union ; this levy was to be utilized *inter alia* to pay an export bounty on butter and cheese. Regulations which have recently been issued under the Act show that the Board has now imposed a levy of 1d. per lb. on all butter, butter substitutes and cheese manufactured in or imported into the Union. Out of the funds derived from this levy a bounty is now being paid on graded butter and cheese exported from the Union. The amount of the bounty, which varies according to the grade of the two commodities, ranges from 3d. to 6d. per lb. in the case of butter and from 3d. to 3½d. per lb. in the case of cheese. In pursuance of a recommendation made by the Board, a further regulation has been issued which prohibits the importation of butter into the Union from all sources other than from the adjoining British Colonies and Protectorates, except under licence granted by the Minister of Agriculture. The quantity of the supplies and the period during which they may be imported under such a licence will be fixed by the Minister.

Scottish Milk Agency.—The following note is a synopsis of a recent address by the Manager of the Scottish Milk Agency, which has attracted much notice as a venture in the field of co-operative marketing. Mr. Magee's address, when the winding-up of the Agency was recently under consideration, was full of interest, reviewing the affairs of the Agency and diagnosing its weaknesses, but of especial value was his analysis of the fundamental problem of organized marketing, particularly in the milk industry.

The first part of the address sketches the history of the Agency. Before it came into being in 1927, there had been annual negotiations between the Milk Committee of the National Farmers' Union of Scotland and representatives of creameries and the distributive trade. The main difference in the new system was that—

"The Agency assumed a legal and binding obligation to pay a basic price to every one of its members, irrespective of whether their milk could be sold in the liquid milk market or not, and its membership was, for all practical purposes, unlimited."

The first year of operation was comparatively successful and ended with a profit of £20,000 because: "The price of our product was fixed in accordance with the general market conditions, or perhaps it would be more correct to say that fortunately the market conditions turned out to be favourable towards the prices which had been fixed."

In the second year "the old traditions and practices of the Conference Agreement (wherein a price was fixed without any regard to liability, because, before the birth of the Agency, there was no liability) were imported into the affairs of the Agency with all its responsibility to pay the fixed prices whether the milk could be sold or not."

Owing to outside influences, the price, according to Mr. Magee, was fixed too high, with the inevitable result. The Agency's liability was widened, production was increased by almost every producer up to the limit of his 10 per cent. allowance, the levy on the members and the revenue obtained from surplus milk were quite inadequate to meet the liability of the Agency, and the reserve built up in the first year was depleted.

The year 1929-30 was also one of difficulty in which the Agency was faced with an increasing volume of surplus milk. Markets which had been previously utilized for dumping surpluses were no longer open and cheese-making was comparatively unprofitable. Once again, to add to the Agency's difficulties, extraneous influences forced the price, in September, 1930, up to 1s. 2½d.—a price which increased the Agency's liability to its members and necessitated the imposition of a 3d. levy which had to be carried over to October.

The difficulties of the Agency seem to have arisen from two main causes: (1) that it had not control over *all* milk producers, and (2) that pressure was brought to bear on the Committee of the Agency to keep the price of liquid milk at too high a level. On these points Mr. Magee's remarks are significant:—

"The Agency was a self-contained trading concern; it had a contractual liability to every member in the Agency; an unlimited liability on one end of the scale and an unknown market at the other. In the circumstances, to fix a price for your produce regardless of your liability, and then to rely upon a levy to cover that liability, is to outrage the elementary rules of commercial practice. The business of the Agency was to sell its members' milk and not to run an Insurance Society for the benefit of those who were not its

members, the premium for which was paid by the members."

When he deals with the constitution of the Agency, Mr. Magee attributes its weakness partly to the fact that it took on the complexion of the conditions of the trade before it.

Each farmer's basic production was fixed on the amount produced in the winter months with a 10 per cent. variation each way, and anything in excess of this was to be regarded as surplus.

"No sooner did the fact of the summer surplus clause, whereby members were paid only the factory price for any part of their production which was above the basic winter quantity, become known, than there was a general demand for members to increase their basic quantity in order to escape the liability for summer surplus."

Herein seems to have lain the source of the Agency's trouble. The liquid milk price fixed by the Committee so stimulated production that, in order to cope with it, the Agency was finally forced to raise its levy, and this led to dissatisfaction and disaffection on the part of the members.

Looking to the future, Mr. Magee states that there is still a widespread feeling that organization in the milk industry is necessary, and in putting the question, "Why the demand for further reorganization?" he makes some pregnant remarks.

"If, by reorganization, you are once again going to make the attempt to put a ring round Glasgow and to attempt a classification of liquid milk suppliers, and for the inner circle to say to the outer circle, "You keep out of here until you are wanted and get on with your cheese-making, and in the meantime we will try and get you some form of protection against imported manufactured products"—you might as well abandon the effort. It is an outworn system and as dead as the dodo. . . . To begin with, the outer circle man may not want to make cheese. He may not like doing it. . . . In any event, he is not the man who is creating your problem. Your problem is the producer within the inner circle who . . . has so stimulated winter production . . . that you have not only created an intolerable burden for yourselves but unreservedly placed yourselves in the hands of your distributors."

Mr. Magee sees little hope in the recommendations of "another prophet" that producers and distributors should "get together" in a spirit of mutual trust.

"You are sellers of a product and the dairymen are buyers of what you produce, and after thirty years' business experience I am convinced that there is no way in which those opposing elements can be brought together except on the basis that the dairymen are your customers and not your masters."

Commenting on the distributors' margin of 10d. per gallon, he says :—

"By comparison with distribution margins elsewhere it is no more than sufficient so long as distribution is conducted in the manner in which it is at the present time . . . If it is necessary that there should be a new orientation in the dairy farming industry I see no reason why there should not be one in the distributing trade also, and it would probably be for their good as well as ours."

There are some significant remarks on the subject of price determination.

"To my mind, the troubles of the dairy-farming industry in this country all spring from the fact that we are inclined to view it from the angle of our liquid milk market and thus become involved in the problems of the milk distributors. . . . At the moment, the whole industry is striving after an assumed liquid milk price and nobody knows who is to get it. . . . To build up a marketing organization upon an assumed liquid milk price which only represents a part of the total of the product concerned is like building a house on shifting sands. . . . Every dairy farmer is striving after an artificial standard. The whole of the industries allied to milk production lie languishing and neglected. . . . I venture the opinion that the only true perspective for the dairy-farming industry is to view milk from the angle of its manufacturing value and to move upwards from there by stages until you reach its true economic level, but never to go above it."

As to the necessity of organization of producers he is not in the slightest doubt :—

"The troubles of your Agency, if you will forgive me saying so, are not so much due to bad management as they are due to bad membership. If you are in earnest about the organization of your industry, then you must work for it, and, if need be, fight for it, for believe me you will be organized anyway. . . . Either you will organize yourselves or the dairymen will organize you in a manner which suits their own ends best. . . . Either you will be a free and independent community of dairy farmers, working out a broad and comprehensive

policy for the betterment of your home industry, or you will be chained to the chariot of the milk distributing trade."

Organized marketing, he concludes as a result of his survey, is fundamentally right :—

"It is right, because as individual producers and marketing entities you could accomplish nothing, but organized you could accomplish anything. Both history and industry teach us that much. Unquestionably organization is fundamentally right, but it must be your own organization and not the invertebrate servant of another."

Report on Fruit Marketing.—Number 24 of the Ministry's Economic Series of Reports has now been published as a "Report on the Preparation of Fruit for Market, Part II."* Part I dealt with the preparation for market of apples, pears, plums and strawberries, and appeared, as Economic Series No. 21, in October, 1928. The present Report, which, like its predecessor, may be described as a "Grower's Guide to Standardization," deals with the remainder of the fruits commonly grown for commercial purposes in this country, viz., gooseberries, currants, cherries, raspberries, loganberries, tomatoes, cucumbers and grapes.

The first section of the Report discusses certain general questions common to the preparation for market of all the fruits concerned. It covers such matters as (i) varietal characters in relation to market requirements, (ii) picking, (iii) the importance and methods of grading, (iv) packages, covers and labels, (v) cold-storage, (vi) the marketing of fruit for jam-making, canning and bottling, and (vii) the relation of growing areas to consuming markets. This section also describes the existing arrangements for the grading and marking, with the National Mark, of tomatoes, cucumbers and cherries, under the Agricultural Produce (Grading and Marking) Act, 1928.

The remainder of the Report consists of a more detailed treatment, for each fruit separately, of varietal characters, methods of picking, grading and packing. Grades are defined and packages are suggested for each of the fruits mentioned. The grades and methods of packing of tomatoes, cucumbers and cherries are those prescribed for National Mark purposes.

* *Report on the Preparation of Fruit for Market (Part II: Gooseberries, Currants, Cherries, Raspberries, Loganberries, Tomatoes, Cucumbers and Grapes)*. Economic Series No. 24, H.M. Stationery Office. Price 6d. net. Post free 9d.

The Report is thus primarily for growers and packers of fruit and, in these days, no grower or packer should be without it. As the Report states, "the retailer's trade is becoming specialized and he buys only those grades which his customers require. If he cannot obtain adequate supplies of graded home-grown fruits, his only alternative is to buy graded and standardized imported produce. The home-grower must adapt his methods to these changing conditions of trade." The grades and packs suggested in the Report have been worked out as a result of a close study of the requirements of distributors on the big urban markets. For this reason, although the Report is primarily intended for the grower and packer, much of the information it contains will be of value to all sections of the distributive trade.

FEBRUARY ON THE FARM

WILLIAM LAWSON, M.B.E., N.D.A., N.D.D.,

Director of Agriculture for West Sussex.

Arable Land.—Towards the end of this month, opportunities may occur for sowing grain crops. All spring-sown cereals require a good tilth; hard places and clods are not a suitable seed-bed for any cereal, but wheat with its deeper rooting system is less exacting than oats; barley is a shallow-rooting plant and requires a really good tilth. The fertility of the soil may compensate to some extent for indifferent tilth and produce a satisfactory crop, but, even under such conditions, the production of a good tilth is well worth while. The poorer soils must be worked to a good tilth and an ideal seed-bed secured in order to grow a full crop. The practical test is to drag the toe along the soil about three inches deep and if it meets with no obstruction then the tilth may be considered satisfactory. For barley, and especially where good grain of malting quality is required, the seed-bed should not only be fine but dry. Such a seed-bed stimulates the roots to seek for moisture and promotes a healthy appearance of the plant. On land where roots have been carted off, the tilth will be best obtained if the land has been ploughed for some time and weathered. Where roots are being folded off, this is not possible and a tilth has to be made. The depth at which land should be ploughed, after sheep have folded off the root crop, will vary with the natural fertility of the soil. Soils that are naturally poor should be ploughed comparatively shallow, about 4 or 5 inches deep, so as to keep the

manure well within reach of the grain crop ; but on richer soils the ploughing can be done to a depth of 6 or 7 inches. In both cases the ploughed soil should be tilled to distribute the manure and make a tilth.

The spring-tined harrow is a very good cultivator for securing a seed-bed and with the ordinary seed harrows will usually be sufficient. If weather permits, it is a good practice to give another harrowing just before the grain appears above ground. This breaks any crust that may have been formed, and stimulates the growth of the plant. Even if no crust should form, this late harrowing is an advantage, especially if grass or clover seeds are to be sown later.

Farmyard Manure.—At this season of the year, when so many of the livestock are housed, farmyard manure is being accumulated. There have been times, and there are still instances, where stock have been and are kept primarily to produce farmyard manure.

Systems of farming based on corn growing have depended largely on stock to tread straw into manure and thus provide a means whereby fertility could be restored and added to the soil. Great care was taken of the manure to preserve its value and prepare it for application to the soil. Higher costs of labour and reduced values of grain, together with the knowledge that artificial manures and green crops ploughed into the soil can bring about much the same results, have rightly modified the practice of making manure for its own sake. Less careful attention to the manure is evident in many districts, and the modern tendency is to convey it to the land with as little labour as possible. Casting or turning the manure heap about a month before it is to be applied to the soil is much less frequently done now than formerly.

On a costing basis, at present values, farmyard manure cannot give direct profit when applied to grain crops ; it can be more economically used for crops of higher value per acre, such as mangolds, potatoes, and market garden crops generally. Whatever its use, the labour costs involved in its application to the land are not lessened by allowing avoidable wastage ; where such wastage occurs, the returns will most certainly be reduced. The best manure is made in boxes or covered yards, where the manure can remain for a time and is trodden firm by the cattle. Such manure, if moved to a mix a few weeks before it is applied to the land, will retain the greatest amount of fertilizing material that is

possible under practical conditions. Manure made in open yards is exposed to rainfall and a certain amount of waste occurs.

Milk production methods are wasteful of farmyard manure. The manure must be removed daily and unless packed tightly in a heap and protected from heavy washing by rain, deterioration is inevitable. Liquid manure has to be conveyed away by drains, and if a tank is provided it frequently overflows and may pollute a stream or ditch ; in any case the overflow continues. Matters are further complicated by the necessity to wash down the floor of the cowstall, and unless a double set of drains is provided the liquid manure is so diluted that its value as a manure is very much reduced.

Opinions vary as to the value of liquid manure. Some farmers make the fullest possible use of all the liquid available ; others never touch it unless compelled to do so to maintain the drainage system or to prevent it becoming a nuisance. Many expensive systems of distribution by pipes and conduits have been installed from time to time, and whilst a few are kept in order and managed successfully a great many have been more or less abandoned. When the liquid manure can be turned into a stream of water that can be used for irrigation purposes considerable benefits may be obtained, but the natural conditions must be favourable, since heavy initial expenditure is not justified. When liquid manure has to be carted, it is important that the distance shall be small. Temporary grass land, particularly where Italian rye-grass is a component of the mixture, responds most freely to liquid manure treatment.

The continued use of liquid manure develops coarseness in the grasses and this should be counteracted by the free use of phosphates and lime.

Poultry.—In very many cases poultry keeping on the general farm has been revolutionized during the last few years. The whole industry—including the specialist breeder, the large commercial poultry farmer and the general farmer—has made great progress since the War. Expansion is most noticeable on the general farm, where a few birds around the farm buildings, managed by some member of the farmer's household, have given place to large units distributed over the farm and managed by paid labour, and mainly devoted to egg production. The extension of grass land has made it possible to extend the poultry stock ; on clean land the poultry are

healthy and the grass land benefits from the consequent scratching and manuring.

In recent years there has been substantial progress on problems of breeding, feeding and prevention of disease. Breeders are trap-nesting their stock, and egg pedigrees are obtainable, in much the same way as milk yields are now part and parcel of the pedigree of dairy cattle. Feeding problems are constantly under investigation, and balanced rations suitable as to nutrients and bulk are in use. Some of the diseases affecting poultry are better understood, and means of prevention by testing to eliminate carriers of disease and inoculation to prevent disease, as well as better hygienic conditions of housing, are all having their effect on the success of the industry.

Hatching and rearing problems are not the least important. The specialist poultry farmer and the commercial poultry farmer usually make a feature of the day-old-chick trade as well as of eggs for hatching. The advent of battery brooding may modify the trade, and if intensive rearing for six weeks is proved successful, then a trade will develop for older birds fit to grow on without artificial heat. In the meantime, the general farmer can choose several methods of replenishing his stock. He can mate his own birds and produce his own hatching eggs, or he can purchase hatching eggs or day-old chicks or older pullets. In deciding to produce his own hatching eggs, he will have to consider the purchase of good strains of cockerels, selected not only for their individual merit but for their breeding for egg laying. The ideal mating would be trap-nested hens of good record and cockerels from proved layers.

Most farmers have not yet undertaken the trap-nesting of their hens, and rely on good cockerels to maintain and improve the egg-producing capacity of their flock. For the heavy breeds, early hatching is recommended; the pullets begin to lay earlier and produce a greater number of eggs at the time when prices are at their best. Egg-laying trials promoted by County Authorities and other bodies indicate the possibilities when the birds are of the right strain, hatched moderately early, and housed and fed under good conditions.

NOTES ON MANURES

H. V. GARNER, M.A., B.Sc.,
Rothamsted Experimental Station.

Manures for Barley.—Numerous experiments have shown that the quality of barley is largely determined by soil and season, whereas the yield is considerably influenced by manures. Moreover, provided that fertilizers are not employed in such quantities that the crop is lodged, the larger crop thus grown will usually be of much the same quality as unmanured barley grown alongside. Indeed, if a considerable yield-increase is produced, the quality may be improved. The aim, therefore, is to manure for as large a crop as is likely to stand up at harvest under local conditions. Of the factors which make for yield, a supply of available nitrogen is one of the most important, and some of the results of experiments on the nitrogenous manuring of barley are collected in Table I below. The first series was that arranged under the auspices of the Institute of Brewing, and carried out from Rothamsted at a number of farms in different parts of the country over the period 1922–26. As a rule, single plots were employed, but these were large and the number of results brought together gives authority to the figures. In general, phosphate and potash were applied, so that the figures may also be regarded as the result of omitting nitrogen from the complete manure. In 1925, the effect of using nitrogen alone was also ascertained.

TABLE I
 YEARLY AVERAGES. YIELDS BUS. PER ACRE

Year	Number of centres	Yield without nitrogen	Increase for 1 cwt. sulphate of ammonia
1922 ..	10	41.6	2.0
1923 ..	14	33.7	8.6
1924 ..	12	36.4	4.3
1925	8	32.7	7.1
1926 ..	13	35.8	1.0
Total ..	57	Mean 36.0	Mean 4.6

It will be seen that, over the series, the use of nitrogen has resulted in a gain of about $4\frac{1}{2}$ bushels. The least satisfactory result was obtained in 1926 when, with a very small yield-increase, the quality of the barleys was depreciated by the nitrogenous manuring. In other years, this did not happen.

The question whether the presence of phosphate and potash is necessary to exploit the action of nitrogen to the full cannot be answered in a general way. In 1925, however, there was some evidence that, on well-farmed land, where abundant

mineral manuring is given at other parts of the rotation, nitrogen exerts almost its full effect when used alone. The figures are given in Table II.

TABLE II
MEAN OF 10 CENTRES. 1925
Gain due to 1 cwt. sulphate of ammonia

Used alone	6.9 bus.
Used with phosphate and potash ..	7.4 "

The withholding of minerals, however, cannot be relied upon as a permanent policy, as the results (Table III) from the Hoosfield permanent barley plots show.

TABLE III
76 YEARS' AVERAGE. BUS. PER ACRE

	<i>No minerals</i>	<i>With minerals</i>
No manure	13.4	19.0
Sulphate of ammonia, 2 cwt. ..	23.7	39.3
Nitrate of soda, 2½ cwt. ..	24.3	37.7

Here the nitrogenous effect is approximately doubled by the addition of phosphates and potash.

On the individual farms of the series examined, cases have also occurred in which phosphate has been necessary to bring out the full effect of nitrogen. At Wellingore in Lincs, where experiments on the above lines are still in progress, this is the case. A recent set of results are given in Table IV.

TABLE IV
WELLINGORE, 1929. YIELDS BUS. PER ACRE
Without phosphate and potash *With phosphate and potash*

No manure	18.8	17.0
Sulphate of ammonia ..	19.5	24.1

The need, or otherwise, of phosphate and potash is, therefore, a local problem to be viewed in relation to previous manuring and the store of available minerals in the soil.

At Rothamsted, replicated experiments have been conducted on the nitrogen responses of barley over a period of years. In general, a basal dressing of phosphate has been supplied and this has frequently been justified. The yield-increases have been quite as satisfactory as in the series at outside centres quoted above. Confining attention to cases in which sulphate of ammonia, or its equivalent, has not been used in excess of 1½ cwt. per acre, the increase following the addition of nitrogen, calculated where necessary to the 1 cwt. basis, is given in Table V.

Concerning the type of nitrogenous manure many data have been collected comparing urea and ammonium chloride with sulphate of ammonia. The results are chiefly of interest in respect of synthetic fertilizer developments which are taking place on the Continent and elsewhere. Both these substances are

TABLE V

Year	Yield without nitrogen		Increase for 1 cwt. sulphate of ammonia	
	Grain in bus.	Straw in cwt.	Grain in bus.	Straw in cwt.
1916 ..	33.8	20.7	7.9	5.8
1920 ..	36.7	22.4	3.5	3.1
1921 ..	26.1	17.6	5.6	3.9
1922 ..	25.2	16.7	5.7	4.2
1923 ..	21.1	14.8	3.2	2.1
1924 ..	23.8	14.1	9.7	5.6
1925 ..	38.6	19.1	9.5	3.8
1927 ..	23.6	15.4	11.2	4.9
1928 ..	28.6	24.4	6.0	6.4
Mean ..	28.6	18.4	6.9	4.4

very similar in their action to sulphate of ammonia, when used in equivalent amounts. Ammonium chloride, as a rule, gives somewhat higher quality, as measured by the nitrogen content, than does the more usual ammonium salt. In recent years the trials have included nitrate of soda and calcium cyanamide, and are therefore of more direct practical interest.

TABLE VI

ROTHAMSTED, 1928-29

	Single dose (23 lb. N)		Double dose (46 lb. N)	
	Grain in bus.	Straw in cwt.	Grain in bus.	Straw in cwt.
1928 No nitrogen ..	23.6	15.4	—	—
Sulphate of ammonia	34.0	20.4	37.8	22.2
Cyanamide ..	36.0	20.8	35.8	20.7
1929 No nitrogen ..	40.2	20.3	—	—
Sulphate of ammonia	46.2	23.9	50.4	24.9
Nitrate of soda ..	51.2	26.7	55.6	27.4
Cyanamide ..	47.2	23.5	52.6	25.6

In these years, cyanamide and sulphate of ammonia have behaved very similarly, whereas, in the dry season of 1929, the nitrates gave definitely better results. In most cases, the double dose produced a small further increase in crop; but, on account of the danger of lodging and also of depreciating the quality of the grain, applications of this size will be unusual in practice.

In manuring barley which is to be undersown, attention should be paid to the effect of the fertilizers on the young seeds. Several observations have been made on this question. Phosphate and potash usually aid in the establishment of the clover constituents of the mixture, the former more particularly on heavy soils, the latter on light soil; on the clay loam at Rothamsted, potash has also notably helped the growth of young clover leys when applied to the nurse crop. On the other hand, the growth of seeds in wet seasons may be so strong

that the clover gives trouble in the sheaves at harvest time. Nitrogenous manuring tends to reduce the growth of clover, and this is most noticeable where the application has been heavy enough to grow much straw or lodge the crop. In ordinary amounts, the effect is probably not serious.

Nitrogen on Grass Land.—The intensive management of grass land by the rotational grazing of small enclosures, successively treated with quick-acting nitrogenous fertilizers, has received much attention in recent years. Not on all farms can such a system be adopted in its complete form, but there is no reason why certain valuable features, which have been observed where such a system has been carried into practice, should not be taken advantage of more generally, particularly since no special outlay or disturbance of the ordinary farm routine need be involved.

Hastening the growth of grass in spring is a case in point. Where nitrogenous fertilizers have been applied to grass land early in spring, vegetation begins distinctly earlier and proceeds more vigorously than on untreated land alongside. Valuable keep can frequently be obtained in this way ten days or a fortnight before the grass under ordinary treatment is fit for stocking, with no more outlay than is necessary to provide and apply the manure. One must not, of course, expect to get grass when the weather is totally unsuited to growth, but, as soon as more genial conditions set in, the treated land has everything in its favour and makes a rapid response.

About 1 cwt. of sulphate of ammonia is the usual application, and about the end of February would be a suitable time to give the dressing. Where it is convenient to give the manure still earlier in the spring, calcium cyanamide might be tried. If, on the other hand, the dressing is delayed, nitro-chalk would be in place.

In the full intensive system, an autumn dressing of phosphate and potash and, in some cases, of lime is recommended. Grass land in ordinary management will usually have been treated with mineral fertilizers in previous years, and, once in a way, a spring application of nitrogen may well be made without any special autumn preparations. If spring top-dressings are habitually given to the same field, this is a reason for generous treatment with minerals every three or four years.

PRICES OF ARTIFICIAL MANURES

Description	Average prices per ton during week ended January 14				Cost per unit at London
	Bristol	Hull	L'pool	London	
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) ..	9 18d	9 18d	9 18d	9 18d	12 9
Nitro-chalk (N. 15½%) ..	9 7d	9 7d	9 7d	9 7d	12 1
Sulphate of ammonia:—					
Neutral (N. 20·6%) ..	9 8d	9 8d	9 8d	9 8d	9 2
Calcium cyanamide (N. 20·6%) }	8 14e	8 14e	8 14e	8 14e	8 5
Kainit (Pot. 14%) ..	3 8	2 10	2 19	3 5	4 8
Potash salts (Pot. 30%) ..	5 6	4 8	5 0	4 19	3 4
(Pot. 20%) ..	3 17	3 0	3 8	3 12	3 7
Muriate of potash (Pot. 50%)	9 17	9 0	9 1	9 7	3 9
Sulphate,, (Pot. 48%)	11 19	11 2	11 2	11 7	4 9
Basic Slag (P.A. 15½%)||	2 13c	2 3c	..	2 9c	3 1
(P.A. 14%)||	2 7c	1 16c	1 16c	2 3c	3 2
(P.A. 11%)||	..	1 9c	1 9c	..	..
Ground rock phosphate (P.A. 26·27½%)||	2 10a	..	2 9a	2 7a	1 9
Superphosphate (S.P.A. 16%)	3 11	..	3 9	3 6	4 2
(S.P.A. 13½%)	3 5	2 18	3 3	3 0	4 4
Bone meal (N. 3½%, P.A. 20½%)	8 15	8 10	8 2	6 12	..
Steamed bone flour (N. ½%, P.A. 27½-29½%) ..	5 19b	5 15f	5 15	4 7	..
Burnt Lump Lime ..	1 5l	1 2m	1 9	1 17h	..
Ground Lime ..	1 12l	1 8m	..	1 12h	..
Limestone ..	1 3l	1 6g	1 8k	..	..
Chalk ..	..	1 6g	..	1 11h	..
Slaked Lime ..	..	..	2 9	2 17h	..

Abbreviations: N.—Nitrogen; P.A.—Phosphoric Acid; S.P.A.—Soluble Phosphoric Acid; Pot.—Potash.

* Prices are for not less than 6-ton lots, for delivery during the month, at purchaser's nearest railway station, unless otherwise stated. Unit values are calculated on carriage paid price.

† Prices are for not less than 2-ton lots, net cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. price.

|| Fineness 85%, through standard sieve.

a Prices for 4-ton lots f.o.r.

b Delivered (within a limited area) at purchaser's nearest railway station.

c Prices for 6-ton lots; at Bristol, f.o.r. Bridgwater; at Hull and Liverpool, f.o.r. neighbouring works, and at London f.o.r. depots in London district.

d For lots of 4 tons and under 6 tons the price is 1s. per ton extra and for lots of 2 tons and under 4 tons 6s. per ton extra.

e Delivered in 4-ton lots at purchaser's nearest railway station.

f Delivered Yorkshire stations.

g F.o.r. Knottingley. Ground limestone 100% through standard sieve.

h Carriage paid 6-ton lots London, bags included.

i In bags, f.o.r. Liverpool. Fineness 45% through standard sieve.

l Carriage paid 6-ton lots Bristol.

m Carriage paid 6-ton lots Knottingley.

* * * * *

NOTES ON FEEDING STUFFS

H. G. SANDERS, M.A., Ph.D.,
School of Agriculture, Cambridge.

Minerals.—Numerous investigations are being made nowadays concerning the mineral content of rations. No useful purpose would be served by attempting here a survey of the whole field, for this is ever-widening and our present knowledge is very imperfect. The subject, however, is of some interest to farmers, and a few general considerations should constantly be borne in mind. Minerals resemble proteins to a certain extent, in being necessary for the maintenance of the animal body, in addition to being included in anything that the body makes, such as milk or new tissue. Hence the body must have a certain minimum if it is to achieve its greatest possible production, or even to keep in good health. Again, many minerals are included in the body, and the parts they play are not interchangeable so that excess of one cannot make up for the deficiency of another. The reverse is true, in fact, for it has been found that if large quantities of one mineral are consumed this may have the effect of leaching others from the body, and cause the appearance of conditions associated with deficiency where these would not otherwise appear. It follows that minerals resemble proteins in having a "biological value," which means that the value of any mineral added to the ration entirely depends on what the mineral balance of the ration was before. Here, however, the analogy with proteins stops short, for minerals are incapable of supplying any energy to the body, as can an excess of protein digestion products, and minerals can be stored up in the animal body to an appreciable extent, so that temporary deficiencies can be safely tided over, whereas the storage of proteins is extremely limited.

Minerals are distributed in small amounts all over the body, but the chief storage takes place in bone, into the composition of which they enter very largely. Bone contains much lime and phosphorus, so that the young animal, particularly a quick grower like the pig, needs fairly considerable quantities of these substances. This need is met by milk, the mineral content of which varies from species to species in accordance with the rate of growth, as illustrated by the table overleaf (taken from an article by Godden in *Agricultural Progress*, 1928),

The milk of a quick-growing species like the pig contains much protein (flesh-forming) and much ash, and, of the latter,

	<i>No of days in which the wgt. of new-born animal is doubled</i>	<i>Milk in species contains (per cent.)</i>				<i>Ash per 1,000 cals. (grammes)</i>
		<i>Protein</i>	<i>Lime (CaO)</i>	<i>Phosph. (P₂O₅)</i>	<i>Total Ash</i>	
Human	180	1.6	0.049	0.056	0.25	3.7
Cow ..	47	3.5	0.161	0.189	0.72	10.5
Pig ..	14	6.7	0.395	0.357	1.03	10.9

the larger proportion consists of lime and phosphorus (bone-forming, since bone consists chiefly of calcium phosphate). As early maturity (*i.e.*, quick growth) is one of the chief points for which stockbreeders are striving, it follows that mineral deficiencies are more liable to arise as livestock are improved. Thus the science of mineral nutrition is new, because it has only been seriously studied in recent years as the need for it became apparent. Its value lies more in the future, and it may be doubted whether we have yet reached the point at which it plays any considerable part in general husbandry.

Since milk contains the relatively high proportion of minerals shown above it is clear that the lactating animal should have a good supply, for if this is not provided in the ration it will be obtained by depleting the stores in the body—a process which cannot go on indefinitely. Pregnant animals, also, are using appreciable quantities of minerals in building up the bodies of their young, and this may have a serious effect on their own supplies, as is believed to happen quite commonly in humans.

In addition to these demands that the body may have to meet in different phases of its life, a certain minimum is necessary for its proper functioning. This is especially true of digestion, which can be absolutely stopped in a short time by complete absence of minerals. At this stage arises the comforting reflection that in practice minerals are never completely absent from the ration; in fact, it is probable that the vast majority of the animals of this country receive a sufficiency of them.

That, in particular districts, certain diseased conditions are occasioned by lack of minerals cannot be denied (Lamziekte, for instance, is prevalent in some parts of South Africa through shortage of phosphorus), but these are special cases of little or no importance to farmers in this country. From this point of view the subject of minerals belongs more to the veterinary profession, which must be in a position to diagnose these conditions correctly and to prescribe for them. Of greater interest to the farmer is the question whether reduced efficiency or lowered resistance to disease is commonly due to imperfect content, or balance, of minerals in the ration, and on this point

it is perhaps premature to dogmatize : many striking results have been obtained experimentally, but there is much contradiction in the literature. To be scientific, one must know the exact demands of the animal body for the different minerals under various conditions, as well as the actual content of the common feeding stuffs, so that foods can be combined to give the correct mineral mixture in the right amount. When it is realized that the mineral content of plants can vary widely according to the soils on which they are grown it can be seen how difficult a matter such mixing will be. Nor is that the whole story, for there is evidence that the amount of minerals absorbed by the animal from the food it eats does not depend entirely on the amount contained in the food, but is affected by the type of food—succulents are believed to contain a vitamin-like substance which raises the assimilation of lime, and sunlight also is thought to aid in a similar way.

At present farmers can do very little to feed their stock correctly as regards minerals, but they should keep in mind the possibility of lack of minerals being a cause of unthriftiness, or even sterility. If mineral deficiency or want of balance is suspected, it will usually be necessary to obtain expert advice, but a preliminary attempt to rectify matters might be made, in an experimental spirit, by changing the foods.

Milk has been described as a "protective" food, by which is meant that it contains all that is needful to the animal as regards protein (that is, the correct balance of amino-acids) and minerals ; nevertheless, it is said to be lacking in iron in some districts. Linseed also has a good mineral content, but this food is not generally used in large quantities, being kept rather for special occasions, as in weaning, &c. ; linseed cake is rich in phosphorus, but only fairly so in lime, and so is not by itself very well balanced, since these two should be present in approximately equal quantities. Bran (especially) and middlings are also quite rich in phosphorus, but they are poor in lime, as is true of oats and cottonseed meal. The foods most useful to balance up these (that is, those rich in lime and comparatively poor in phosphorus) are leguminous ones, especially lucerne and clover. A number of feeding stuffs contain very little in the way of minerals, and among these must be included mangolds, swedes, barley, maize, brewers' grains, and sugar-beet pulp ; hay and grass are unknown quantities, since their composition is quite closely a reflection of the mineral content of the soil in which they are grown.

It will readily be realized that no attempt has been made here

to give a complete account of our knowledge of mineral nutrition. Nevertheless, it is hoped that with these considerations before him a farmer will conclude that it is unwise to add mineral mixtures indiscriminately to a ration. What is one man's meat is another man's poison, and what may be needed to supplement the mineral composition of one ration may only succeed in unbalancing another.

Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follow :—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (imported)	71	6.2	4 8
Maize	81	6.8	4 14
Decorticated ground nut cake	73	41.0	8 0
„ cotton cake	71	34.0	7 0

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 1.15 shillings, and per unit protein equivalent, 2.05 shillings. An explanation of the method of calculation employed is given in the Report of the Departmental Committee on Rationing of Dairy Cows.*

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The “food values” which it is recommended should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows are given in the November, 1930, issue of the Ministry's JOURNAL.)

FARM VALUES

Crops	Starch equivalent Per cent.	Protein equivalent Per cent.	Food value per ton, on farm £ s.
Wheat	72	9.6	5 2
Oats	60	7.6	4 5
Barley	71	6.2	4 14
Potatoes	18	0.6	1 2
Swedes	7	0.7	0 9
Mangolds	7	0.4	0 9
Beans	66	20.0	5 17
Good meadow hay	37	4.6	2 12
Good oat straw	20	0.9	1 5
Good clover hay	38	7.0	2 18
Vetch and oat silage	13	1.6	0 18
Barley straw	23	0.7	1 8
Wheat straw	13	0.1	0 15
Bean straw	23	1.7	1 10

* Obtainable from H.M. Stationery Office, Adastral House, Kingsway, W.C. 2. Price 6d. net.

Description	Price per qr.		Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.		Price per lb. starch equiv.	Pro- tein equiv.
	s. d.	lb.	£ s.	£ s.	£ s.		s. d.	d.	%	
Wheat, British	—	—	6 5	0 11	5 14	72	1 7	0-85	9-6	
Barley, British feeding	—	—	5 15	0 9	5 6	71	1 6	0-80	8-2	
" Danubian	16 0	400	4 10	0 9	4 1	71	1 2	0-62	6-2	
" Persian	15 0	"	4 3	0 9	3 14	71	1 1	0-58	6-2	
" Russian	16 0	"	4 10	0 9	4 1	71	1 2	0-62	6-2	
Oats, English, white	—	—	6 0	0 9	5 11	60	1 10	0-98	7-6	
" " black and grey	—	—	5 10	0 9	5 1	60	1 8	0-89	7-6	
" Canadian mixed feed	11 6	320	4 0*	0 9	3 11	60	1 2	0-62	7-6	
" Argentine	12 6	"	4 7	0 9	3 18	60	1 4	0-71	7-6	
" Chilian tawny	13 6	"	4 15	0 9	4 6	60	1 5	0-76	7-6	
" German	20 3	"	7 2†	0 9	6 13	60	2 3	1-20	7-6	
" Russian	15 0	"	5 5	0 9	4 16	60	1 7	0-85	7-6	
Maize, Argentine	18 3	480	4 5	0 9	3 16	81	0 11	0-49	6-8	
" South African	22 0	"	5 3†	0 9	4 14	81	1 2	0-62	6-8	
Beans, English Winter	—	—	5 10‡	1 2	4 8	66	1 4	0-71	20	
Peas, English Blue	—	—	7 5§	0 19	6 6	69	1 10	0-98	18	
" Indian	—	—	9 0†	0 19	8 1	69	2 4	1-25	18	
" Japanese	—	—	15 10†	0 19	14 11	69	4 3	2-28	18	
Dari	—	—	7 10	0 10	7 0	74	1 11	1-03	7-2	
Milling offals—										
Bran, British	—	—	5 12	1 0	4 12	42	2 2	1-16	10	
" broad	—	—	6 15	1 0	5 15	42	2 9	1-47	10	
Middlings, fine, imported	—	—	5 17	0 15	5 2	69	1 6	0-80	12	
" coarse, British	—	—	5 12	0 15	4 17	58	1 8	0-89	11	
Pollards, imported	—	—	4 15	1 0	3 15	60	1 3	0-67	11	
Meal, barley	—	—	5 17	0 9	5 8	71	1 6	0-80	6-2	
" maize	—	—	6 2	0 9	5 13	81	1 5	0-76	6-8	
" " South African	—	—	5 15	0 9	5 6	81	1 4	0-71	6-8	
" " germ	—	—	5 15	0 14	5 1	85	1 2	0-62	10	
" locust bean	—	—	5 12	0 7	5 5	71	1 6	0-80	3-6	
" bean	—	—	8 15	1 2	7 13	66	2 4	1-25	20	
" fish	—	—	18 10	2 18	15 12	53	5 11	3-17	48	
Maize, cooked flaked	—	—	6 15	0 9	6 6	83	1 6	0-80	8-6	
" gluten feed	—	—	6 7	0 18	5 9	76	1 5	0-76	19	
Linseed cake, English, 12% oil ..	—	—	9 12	1 6	8 6	74	2 3	1-20	25	
" " " 9% "	—	—	9 1	1 6	7 15	74	2 1	1-12	25	
" " " 8% "	—	—	8 17	1 6	7 11	74	2 0	1-07	25	
Soya bean cake, 5½% oil ..	—	—	7 17*	1 17	6 0	69	1 9	0-94	36	
Cottonseed cake—										
" " English, 4½% oil ..	—	—	4 12	1 5	3 7	42	1 7	0-85	17	
" " Egyptian, 4½% " ..	—	—	4 0	1 5	2 15	42	1 4	0-71	17	
Decorticated cottonseed meal, 7% oil	—	—	9 5*	1 17	7 8	74	2 0	1-07	35	
Ground-nut cake, 6-7% oil ..	—	—	5 15*	1 5	4 10	57	1 7	0-85	27	
Decorticated ground-nut cake, 6-7% oil	—	—	8 0	1 18	6 2	73	1 8	0-89	41	
Palm kernel meal, 1-2% " ..	—	—	4 17	0 16	4 1	71	1 2	0-62	17	
Feeding treacle	—	—	5 15	0 8	5 7	51	2 1	1-12	2-7	
Brewers' grains, dried ale ..	—	—	4 5	0 16	3 9	48	1 5	0-76	13	
" " " porter	—	—	3 17	0 16	3 1	48	1 3	0-67	13	
Malt culms	—	—	5 0†	1 5	3 15	43	1 9	0-94	16	
Dried sugar beet pulp (a) ..	—	—	4 10	0 8	4 2	65	1 3	0-67	5-2	

* At Bristol.

† At Liverpool.

‡ At Hull.

(a) Carriage paid on 4-ton lots.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price at mill or store. The prices were current at the end of December, 1930, and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative values of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, if palm kernel cake is offered locally at 57 per ton, then since its material value is 15s. per ton as shown above, the food value per ton is 24s. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 1s. 8d. Dividing this again by 23-4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 0-76d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculation a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own markets. The figures given in the table under the heading material value per ton are calculated on the basis of the following unit prices:—S., 8d.; F.O., 8s. 11d.; K.O., 8s. 6d.

MISCELLANEOUS NOTES

DURING the coming season, the Ministry will continue to test potatoes and potato seedlings, as hitherto, in regard to their immunity from or susceptibility to wart disease. The tests will be carried out at the Potato Testing Station of the National Institute of Agricultural Botany at Ormskirk on the conditions stated below.

Wart Disease Immunity Trials, 1931

The entry form (No. 345 H.D.), obtainable from the Ministry, should be filled up and returned to the Potato Testing Station, Ormskirk, Lancs., *with the requisite fees.* Samples must be sent to that Station *as early as possible, but in any case not later than March 1.*

Potatoes are accepted from *English, Scottish and Irish growers* for trial under the following conditions:—

(a) Quantity of each stock of Potato to be sent for the first time—50 seed size tubers.

Quantity of each stock of Potato to be sent for the second and for subsequent years—35 seed size tubers.

(b) Fees on the following scale are payable in respect of each stock of Potato when first entered for immunity trials:—

Less than 5 samples from one grower 10s. per sample.

5 samples or more from one grower 8s. per sample up to 20, and 6s. for each sample in excess of 20.

These fees are not returnable under any circumstances.

(c) The Ministry, while taking reasonable precautions to secure satisfactory growth, can accept no responsibility for the failure of any variety.

(d) The Ministry will take all reasonable precautions to secure that all the produce of the trial plots is fed to stock after being thoroughly mixed together, except such portions as may be needed for exhibition or scientific purposes authorized by the Ministry. The Ministry, however, reserves the right to send tubers from the produce grown at Ormskirk for testing at the official stations of the Department of Agriculture for Scotland and the Ministry of Agriculture for Northern Ireland.

(e) All stocks entered for the trials will be tested both in the laboratory and in the field. When the Ministry is satisfied as a result of the trials that a variety is immune from Wart Disease, it will formally "approve" the variety and will issue an official certificate of immunity. Such certificates will not be issued until the variety has been named and until an assurance has been received from the sender that it has been, or is about to be, introduced into commerce. *When a variety tested under a number or letter has been subsequently named and "approved," a sample of 100 tubers of the variety as named must be sent to Ormskirk for comparison with the tested stock.* No certificate will be issued for any new variety until it has passed at least two consecutive years' tests without contracting the disease, and has been declared by the Synonym Committee of the National Institute of Agricultural Botany to be distinct from existing varieties.

Potatoes are accepted from foreign growers on the conditions (a) to (d) set out above, but no foreign variety will be formally "approved" and no certificate will be issued until the variety is definitely introduced into commerce in Great Britain.

Trials of Seedlings.—The Ministry desires to encourage the breeding of new varieties of potatoes, and in order to provide information for breeders of seedlings it is prepared to accept not fewer than two tubers, and not more than ten tubers, of any seedlings for testing in the laboratory and growing for one season on the trial plots, and to furnish a report on the results obtained, without payment of a fee. These tests, however, will not be considered as forming part of the Immunity Trials proper and will not be reckoned in the minimum period of two years referred to under (e). The results of these tests will not be included in any report issued by the Ministry.

GENERAL INSTRUCTIONS: *Carriage.*—Small consignments should be sent by passenger train, carriage paid, or by parcel post; larger consignments should be forwarded by goods train, carriage paid.

Labels.—All consignments should be distinctly labelled. A label bearing the name and address of the sender and name of variety or seedling number should be firmly tied to the bag; in addition a similar label should be placed inside the bag.

Address.—All consignments should be addressed to:—

THE SUPERINTENDENT,

POTATO TESTING STATION,

NATIONAL INSTITUTE OF AGRICULTURAL BOTANY,
ORMSKIRK, LANCs.

Station: Ormskirk, L.M. & S. Railway.

Date of Forwarding.—Consignments should be sent so as to reach the Testing Station as early as possible and in any case not later than March 1.

THE index number of the prices of agricultural produce during December was 26 per cent. above the level of the base years, 1911–13, as compared with 29 per

The Agricultural cent. and 43 per cent. a month and a
Index Number year earlier, respectively. While the index

numbers of nearly all descriptions of produce showed a fall, the main factors in the drop of three points in the general figure were the lower indices recorded for grain, fat cattle and fat sheep, although these reductions were partially offset by an increase in the index for milk.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1925:—

Month	Percentage increase compared with the average of the corresponding month in 1911-13.					
	1925	1926	1927	1928	1929	1930
January	71	58	49	45	45	48
February	69	53	45	43	44	44
March	66	49	43	45	43	39
April	59	52	43	51	46	37
May	57	50	42	54	44	34
June	53	48	41	53	40	31
July	49	48	42	45	41	34
August	54	49	42	44	52	35
September	55	55	43	44	52	42
October	53	48	40	39	42	29
November	54	48	37	41	44	29
December	54	46	38	40	43	26

Grain.—Values for grain receded further, the averages for wheat, barley and oats falling by 7d., 1s. 2d. and 3d. respectively per cwt. The index figures for wheat and oats were six and three points lower on the month at 17 per cent. and 20 per cent. below 1911-13, while in the case of oats a reduction of 11 points was recorded, and this fall brought oats to precisely the pre-war level. As compared with the corresponding period a year ago wheat was cheaper on average by 3s. 4d. per cwt., barley by 7d. and oats by 1s. 7d.

Live Stock.—Prices of fat cattle were a trifle higher in December than in the preceding month, but as the rise was proportionately much smaller than in the base years, the index number fell by eight points to 20 per cent. above 1911-13. Similarly, although quotations for fat sheep were practically unchanged, the index figure was nine points lower at 44 per cent. in excess of the base level. In December, 1929, fat cattle averaged 30 per cent. and fat sheep 53 per cent. above 1911-13. Bacon pigs failed to maintain the slight rise in price recorded during November, and the index figure declined by three points to 26 per cent. above 1911-13. On the other hand, porkers were three points higher at 53 per cent. over pre-war. Dairy cows and store cattle showed little change either in price or index number. Values for store sheep were a little higher, but the index number was six points lower at 50 per cent. in excess of the base years. Quotations for store pigs receded somewhat, and the index figure declined by seven points to 104 per cent. above pre-war.

Dairy and Poultry Produce.—During the month under review, the contract price of milk in most districts was rather higher than in November, with the result that the average rose by about $\frac{3}{4}$ d. per gallon, and the index number by eight points to 65 per cent. over 1911-13. Butter prices showed a little recovery

from the recent low levels, and the index advanced by two points to 12 per cent. above pre-war, while cheese was practically unaltered, the index remaining at 16 per cent. in excess of 1911-13. Eggs were $5\frac{1}{2}d.$ per dozen cheaper, and the index number fell by 19 points to 14 per cent. in excess of the base level. A year ago eggs were 47 per cent. dearer than pre-war. Quotations for poultry were rather higher, on account of the seasonal demand, but the increase in price was much less pronounced than in the base years, and the index figure was five points lower on the month.

Other Commodities.—Potato prices continued to advance during December, and the index number rose by three points to 49 per cent. over pre-war, which compares with only 10 per cent. at the corresponding period a year earlier. Hay showed no change either in price or index number. Apples were dearer than in November at 44 per cent. over 1911-13, but vegetables were cheaper as a rule at an average of 27 per cent. over pre-war. Values for wool were again slightly lower at 19 per cent. less than in pre-war years.

Index numbers of different commodities during recent months and in December, 1928 and 1929, are shown below :—

Percentage increase as compared with the average prices ruling in the corresponding months of 1911-13.

Commodity	1928	1929	1930			
	Dec.	Dec.	Sept.	Oct.	Nov.	Dec.
Wheat	31	28	—3*	—7*	—11*	—17*
Barley	24	7	3	13	11	Nil
Oats	29	2	—12*	—12*	—17*	—20*
Fat cattle ..	27	30	35	31	28	20
„ sheep ..	50	53	62	62	53	44
Bacon pigs ..	26	64	33	25	29	26
Pork „ ..	36	77	44	45	50	53
Dairy cows ..	34	31	31	30	31	30
Store cattle ..	21	17	27	27	23	22
Store sheep ..	49	48	69	62	56	50
Store pigs ..	30	108	107	107	111	104
Eggs	37	47	36	56	33	14
Poultry	45	34	40	39	36	31
Milk	71	67	100	47	57	65
Butter	50	45	24	14	10	12
Cheese	79	32	22	17	16	16
Potatoes	45	10	51	40	46	49
Hay	8	41	11	—4*	—7*	—7*
Wool	66	39	—8*	—12*	—17*	—19*

* Decrease.

Enforcement of Minimum Rates of Wages.—During the month ending January 14, legal proceedings were instituted against four employers for failure to pay the minimum rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases are as follows :—

County	Court	Fines		Costs		Arrears of wages		No. of workers involved
		£	s. d.	£	s. d.	£	s. d.	
Lancaster ..	Warrington	1	0 0	0	5 0	6	10 0	1
Yorks E.R. ..	Hull ..	2	2 0	—	—	15	4 7	2
„ W.R. ...	Rotherham	0	8 0	1	1 0	17	11 8	1
Glamorgan ..	Pontardawo	1	0 0	2	2 0	8	4 4	1
		£4 10 0		£3 8 0		£47 10 7		5

APPOINTMENTS

COUNTY AGRICULTURAL EDUCATION STAFFS : ENGLAND

Lincolnshire (Holland) : Mr. F. W. Handley, B.Sc., Ph.D., Assistant Agricultural Chemist, has been promoted Agricultural Chemist, *vice* Mr. M. N. Nicholson, B.Sc., A.I.C.

Mr. E. R. Wallace, B.A., has been appointed Agricultural Mycologist, *vice* Mr. W. F. Cheal, D.I.C., N.D.A.

Nottinghamshire : Mr. K. D. R. Davis, M.A., has been appointed Assistant Agricultural Organizer, *vice* Mr. A. Voysey, B.Sc.

Somersetshire : Miss M. L. Mann, N.D.P., has been appointed Assistant Instructress in Poultry-keeping, *vice* Miss N. Collier, N.D.P.

Sussex (West) : Miss E. G. Stoward, N.D.P., has been appointed Instructress in Poultry Husbandry, *vice* Mr. F. A. Kent, N.D.P.

Warwickshire : Mr. P. Cragg* has been appointed Assistant Instructor in Horticulture, *vice* Mr. C. R. S. Gregory, N.D.H.

Yorkshire (Agricultural Department, University of Leeds) : Mr. D. Witney, B.Com., has been appointed Assistant Lecturer in Agricultural Economics, *vice* Mr. V. Liversage, B.Sc., N.D.A.

* Wholly employed by the County Council, but only partially on agricultural education work.

WALES

The announcement, in the January, 1931, issue, of the appointment of officers in the County of Glamorgan is amended to read as follows :—

Glamorganshire : Mr. Frederick Blakemore, M.R.C.V.S., Instructor in Veterinary Science.

Mr. E. Ll. Harry, B.Sc. (Agric.), Instructor in Agricultural Economics.

Mr. William Williams, M.Sc. (Agric.), Instructor in Agriculture.

Mr. H. R. Jenkins, N.D.P., Instructor in Small Live Stock.

Mr. William Evans, N.D.P., Instructor in Poultry Husbandry.

The following further appointments are notified :—

Denbighshire : Mr. Emrys Davies, B.Sc. (Wales), has been appointed as Assistant Organizer and Lecturer in Agricultural Science, *vice* Mr. J. S. Roberts, temporarily acting in this capacity.

Monmouthshire : Mr. C. H. King has been appointed Assistant Poultry Instructor, *vice* Mr. F. R. Wallbutton who resigned to take up an appointment in Somersetshire.

NOTICES OF BOOKS

History of the British Friesian Cattle. Pp. 552. (London: British Friesian Cattle Society, 11 Southampton Row, W.C. 1. Lewes: W. E. Baxter, Ltd. Price 7s. 6d.)

From time to time, notably during the seventeenth and eighteenth centuries, native British breeds of cattle have been considerably modified by imported Dutch stock. In addition, large numbers of cows were brought over from Holland during the "seventies" and "eighties" of last century. Further importations have taken place in recent years, with results which are visible in the British Friesian cattle of to-day. All that is known concerning the history of the breed is here given, together with information concerning pedigrees and performances, and a history of the British Friesian Cattle Society from its foundation, in 1909, down to the present date. The book should be of service to cattle breeders and milk producers, as well as to students of agricultural history.

Vocational Education in Agriculture. International Labour Office Studies and Reports: Series K (Agriculture), No. 9. Pp. vii + 244. (London: P. S. King & Son, Ltd. Price 5s.)

With the object of obtaining information likely to prove useful to authorities interested in the vocational education of rural populations, the International Labour Office some six years ago addressed a questionnaire to all States Members of the International Labour Organization. The report is based on replies received from 32 countries, in most cases accompanied by reports of agricultural and educational departments, texts of laws, periodicals, pamphlets and other annexes. Part I defines and classifies various systems of vocational agricultural training. In the rest of the book is given detailed information regarding the facilities for agricultural education existing in the countries which have supplied data.

The Agricultural Extension System of the United States. By C. B. Smith, M.S., D.Sc., and M. C. Wilson, B.S. Pp. x + 402. (New York: J. Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Price 17s. 6d. net.)

The agricultural extension system of the United States entails an annual expenditure of some \$23,000,000, and employs nearly 6,000 federal, state and county officials, co-operating with approximately 250,000 volunteer workers and a million and a-half "farm and home" demonstrators. The work upon which they are engaged, some of the results which have been achieved, and the programme for the future are described in this volume with the aid of numerous figures and graphs.

The Agricultural Note-Book. By P. McConnell, B.Sc. 11th edition. Pp. xi + 540. (London: Crosby, Lockwood and Son, 1930. Price 15s. net.)

The first edition of this well-known work of reference was published in 1883 and the tenth in 1922. Developments in agricultural science and practice during the past eight years have necessitated adjustment and additions on some 250 pages of the present edition. The most important alterations will be found in the sections dealing with sugar beet, soils and manures, plant diseases, dairy rations, milk standards, livestock points, livestock diseases, poultry breeding, livestock and fruit pests. Everybody concerned in agriculture should find the book of service.

Index to the Literature of Food Investigation. Vol. II, Nos. 1 and 2. (London: His Majesty's Stationery Office. 1930. Price 2s. net each.)

Three years ago, the Imperial Research Conference recommended that research institutes throughout the Empire should forward their publications on the preservation and transport of food to the Low Temperature Research Station at Cambridge, which in its turn should issue to such research institutes periodical bibliographies of the subject. So far, four indexes have been issued, each containing a list of published papers arranged under subject headings. The preface to the present volume details the more noteworthy developments which occurred during the year 1928-1929.

East Yorkshire: A Study in Agricultural Geography. By S. E. J. Best, B.Sc., Ph.D., F.R.G.S. Foreword by G. B. Fawcett, D.Sc. Pp. xv+189. (London: Longmans, Green and Co. Price 16s. net.)

A regional survey of a rural area. Following a preliminary discussion of the physical features and geological formation of the area, the author delimits 13 soil regions, which are correlated with the distribution of crops and population. Fluctuations in population are illustrated by a series of graphs, crop distribution by tables, diagrams and maps. An interesting chapter is devoted to the agricultural history of the district, and the survey concludes with a picture of the East Riding of to-day.

Crop Production and Management. By J. F. Cox. 2nd ed. Illustrated. Pp. xii+469. (New York: J. Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Price 13s. 6d.)

Since its first publication, in 1924, this book has been used extensively by agricultural institutes and experimental stations in the United States of America. The original title included a reference to "Soil Management," a subject concerning which so much has been written during the past six years that detailed discussion was deemed unnecessary in the present revision. Special emphasis is laid on the methods employed by successful farmers in the northern and corn-belt States. Throughout the book, American practice is implied, and for this reason its appeal to the British agriculturist must be largely academic.

Agricultural Co-operation in England: A Survey by the Horace Plunkett Foundation. Pp. viii+272. (London: George Routledge & Sons, Ltd. Price 7s. 6d. net.)

Sir Horace Plunkett's achievements in regard to agricultural co-operation form a classic chapter in the economic history of the British Isles. The Foundation which bears his name aims at supplying to the interested public all available information on the subject by means of a Year Book, supplemented by occasional volumes dealing with the development of co-operative practice throughout the world. The present survey appears at an opportune moment, when an Agricultural Marketing Bill is being discussed in Parliament and National Mark Schemes are encouraging co-operative effort in various branches of the industry. In a foreword, Sir Horace describes the survey as "an account of a very substantial achievement, a complete answer to the common cry that farmers cannot or will not organise." The book gives evidence, "which few may have suspected, of real vitality in the farming community." We are told that there are in England alone 230 societies, comprising 67,526 members, with 97,467 customers, a share capital of £1,117,727, and a total turnover in 1929 of £9,800,230. Of every 100 English farmers 19 are members of an agricultural co-

operative society, while 28 do at least part of their business with a society.

Brief chapters on the history of the movement and on the structure of existing societies are followed by a survey of all England by counties; each section contains detailed information concerning all known agricultural co-operative organizations in a particular county, their special purpose, membership and financial results. Most progress appears to have been made in the purchase of requirements such as manures, seeds and feeding stuffs. Whereas the turnover from the sale of farm produce of various kinds in the year 1929 was £2,910,484, the corresponding figure for agricultural requirements amounted to £6,889,746. Consumers' societies would seem to be typical of the movement in England, as are creameries in Ireland and credit societies in central Europe.

Of more recent and sporadic growth are marketing societies. Milk was one of the first commodities to engage attention. Less progress has been made with livestock, meat, fruit and wool. Egg marketing has received a strong stimulus from the introduction of the National Mark.

The survey concludes that prospects are by no means discouraging. While still insufficiently consolidated, the movement has passed through a series of crises including the post-war boom years, the ensuing slump, the failure of the Agricultural Wholesale Society, the cessation of the Agricultural Organization Society, and, more recently, the steep decline in prices. A system which can survive in such circumstances certainly gives evidence of vitality.

This is no mere "work of reference," but an up-to-date manual on co-operation.

Judging Poultry for Production. By J. E. Rice, G. O. Hall and D. R. Marble. Pp. xii + 425. Illustrated. (New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Price 18s. 6d. net.

Poultry judging may be said to have begun with poultry keeping. At first, selection was based mainly on the fighting qualities of the cocks, but the sense of beauty early expressed itself in a desire to breed birds of gay plumage and striking type. In the nature of things, just when and how food values became the dominant objectives in the choice of birds must remain an insoluble mystery, but it is significant that Columella and Stephanus, who wrote, respectively, in the first and sixth centuries A.D., both attached importance to physical characters indicative of egg and flesh production. The invention of the trapnest ushered in an entirely new epoch in the poultry industry, and with it an entirely new science and art of judging in which physical examination has taken a place as an essential part of the procedure.

The present volume assembles and classifies the most recent data regarding judging for vitality and production, as well as the relation of these to the selection of fancy birds. There are chapters on the influence of heredity and environment, on constitutional vigour, physiology, pigmentation, moulting, the head, body-type and internal anatomy, all considered in relation to productivity, while the practice of culling and selection receives extensive treatment. There are numerous illustrations and tables, a bibliography which is probably exhaustive so far as America is concerned, and a good glossary. As might be expected in an American publication, Part III concerning educational facilities in poultry judging refers exclusively to transatlantic institutions and methods. Other sections would require some adaptation in the light of conditions on this side. This apart, the book contains a large amount of information that should prove useful to the British poultry-keeper and judge.

Size and Form in Plants. By F. O. Bower, Sc.D., LL.D., F.R.S.
Pp. xiv + 232. Illustrated. (London: Macmillan & Co., Ltd.
Price 12s. 6d. net.)

Why has a given plant certain dimensions; why cannot it appear as a magnified or reduced image, say, ten times or one-tenth of its normal size? Sachs in his essay on size-relation, published in 1893, pointed out that a correlation existed between dimension and organization which rendered this mechanically and physically impossible, and he proceeded to illustrate this position by reference to cellular construction. The present discussion of the subject is based rather on the morphology of tissue-masses. Professor Bower draws upon his comprehensive knowledge of the Vascular Cryptogams in some of which morphoplastic problems can be studied without the complication of secondary growth, and with the aid of singularly clear figures and tables he demonstrates the intimate association of increasing complexity and increasing size. Physiologist and morphologist alike should find this study stimulating and provocative.

Progress in English Farming Systems. IV.—*Another Departure in Plough Farming.* By C. S. Orwin. Pp. 16. (London: Humphrey Milford, Oxford University Press. 1930. Price 1s. net.)

This study describes the agricultural experience of Mr. F. P. Chamberlain, who entered upon the tenancy of Crowmarsh Battle Farm in Oxfordshire in 1894, in which year the average price of wheat fell to the lowest point of the century. The holding is 550 acres in extent, arable with the exception of 10 acres occupied by buildings and roads, 40 acres of pasture and 65 acres planted in recent years with fruit. The previous occupier had farmed on the local system of corn and stock—bullock feeding and hurdle sheep—but Mr. Chamberlain introduced a milking herd of between 50 and 60 non-pedigree Shorthorns and dispensed with the sheep. Some 21 years ago, however, in the light of experience gained on the farms, he decided to concentrate entirely on the production of arable crops, the only live stock he retained on the farm being 10 horses. No rotation is observed, cropping being determined solely by the nature of the soil and the cleanliness of the land. All crops are sold off the farm. To maintain fertility and humus, reliance is placed on artificial manures and the turning in of second-growth clover: cleanliness of the land is maintained by a fallow. The regular labour force is stabilized at 11 men. Until the end of 1926, Mr. Chamberlain depended upon the hire of steam tackle for ploughing and cultivation, but during the past three years tractors and tractor implements have been acquired for all tillage purposes; two horses have been sold and the cable ploughs dispensed with. Although the area under cultivation is insufficient to keep two tractors in constant employment, Mr. Chamberlain estimates that the introduction of tractors has reduced his mechanical cultivation costs by some £50 per annum. It is said to be largely due to this mechanization that a return on capital has been made during the period 1923/4-1928/9.

* * * * *

THE JOURNAL OF THE MINISTRY OF AGRICULTURE

Vol. XXXVII. No. 12.

MARCH, 1931.

NOTES FOR THE MONTH

A CONFERENCE on "The Making of New Grass Land" was held at the Rothamsted Experimental Station on February 11. There was a large gathering

Laying Down of farmers and agricultural officers from
Land to Grass many parts of the country, and Sir Daniel Hall took the Chair. All con-

nected with farming are aware of the large amount of useful knowledge that is stored in the minds of thoughtful and observant farmers. Much of it would be quite unavailable were it not for meetings such as that under notice. Seven of the nine papers read had been prepared by farmers who had put down considerable areas of land to grass in their respective districts with marked success. As the localities dealt with ranged from wet districts in the North of Scotland to the drier parts of the Eastern counties, it was not surprising that very sharp differences of opinion existed in regard to the most suitable varieties of grasses and clovers, and the correct lines of management in the critical early years of the pasture. There were, however, different views on matters of cleanliness of seed bed and surface cultivation which were not so easily explained by local conditions, and the many points of this kind that were raised at the Conference might well be critically examined by experimenters.

The papers formed a very valuable record of experience and they will be published in due course.*

Mr. James Cruickshank (Aberdeen) described the system whereby he had transformed a poor clay arable farm into excellent temporary and permanent grass. Simple mixtures were sown under a light crop of barley and generously treated with slag or rock phosphate. For the first two years early hay crops were taken to prevent poaching this heavy soil in wet weather.

* Rothamsted Conferences, No. 11, Ernest Benn, London, 1931.
(In preparation.)

Mr. Findlay (North of Scotland College of Agriculture) gave an interesting account of his work on varieties and strains of grasses and clovers. It was clear from other papers that this work had greatly influenced local farming.

Major James Keith (Aberdeen) spoke of the striking improvement in his temporary leys that had followed the introduction of wild white clover. He described his efforts to utilize the fertility put into the land when these leys were broken up, and found it best to take two root crops on such land before coming into cereals.

Captain A. R. McDougal (Berwickshire) set out the methods whereby he had improved a large area of worthless grass, much of it at high altitudes. Manuring had been useless, and ploughing out and re-seeding was his solution. Capt. McDougal has employed observation plots of grasses and clovers on his uplands for many years and based his mixtures on the results.

Coming now to the Eastern Counties, Mr. W. S. Mansfield (Cambridge University Farm) dealt with the question of laying heavy soils to grass under light rainfall. The introduction of wild white clovers had greatly assisted what was formerly a difficult task. The strain and quality of the wild white clover seed must, however, be of the best. Close, even grazing in the first year with mixed stock or with sheep was the most rapid method of establishing a sole in a new pasture. The common practice of haying in the first year postponed the formation of a close bottom.

Mr. J. Alston (Norwich) always aimed at sowing on clean land in good heart; like the previous speaker he used simple mixtures with a good seeding of wild white clover and grazed in the first year. Cocksfoot was an essential species for early keep on light land.

Several novel practices that had worked well on his land were mentioned by Mr. C. H. Gardner (Bedfordshire). The new pastures were not fenced off from the old, and were manured and reseeded (through the cattle) from the rich old pastures. Light seedings were used in the first instance. Harrowing was unnecessary as his fields were always adequately stocked and trodden: furthermore, harrowing tended to destroy seedlings in the manure.

[Mr. Gardner farms near the chalk and, in such circumstances, the grass sod is generally free from "mat."]

Mr. A. McArthur (Hertfordshire) described "how he had established 20 acres of excellent grass. His main species were wild white clover and perennial ryegrass. Cocksfoot, so well

spoken of by others, he did not use because it was distasteful to stock.

Mr. Martin Jones (Imperial Chemical Industries) dealt with the question of strains of pasture plants in relation to their leafiness and persistence, and showed how it was possible, by suitable grazing and manuring, to utilize the quick-growing varieties in the early years without repressing the perennial species that were to form the basis of the permanent pasture.

Several points stood out on reviewing the papers and subsequent discussion ; in particular the leading places of wild white clover and phosphatic manuring in grassland farming ; the value of indigenous strains of grass and clovers ; and the importance of good after-management.

THE following statement was made by the Prime Minister in the House of Commons on February 12:—"The Government

Sugar-Beet have given careful consideration to the position of the sugar-beet industry. In
Growing in 1931 view of the general industrial situation, the Government have, naturally, been most reluctant to consider the grant of additional aid to an industry which is already subsidized. But the position which has resulted from the unprecedented fall in sugar values, to a figure far below pre-war values, in a year when the statutory rate of subsidy will be halved, is so exceptional that they have decided, subject to the approval of Parliament, to offer a special advance to the industry for one year only, the advance to be deducted, in the event of sugar prices rising substantially, from the normal subsidy which will be due in the last two years of the subsidy period. The amount of the special advance is to be limited to 1s. 3d. per cwt. of sugar, payable on 300,000 cwt. of sugar (ex 98°) manufactured per factory in the 1931-32 campaign, and is to be payable on the following conditions :—

"(i) A firm price to be offered by factories to farmers which shall give them the full equivalent of the special advance and, generally speaking, shall require from factories in 1931-32 a maximum sacrifice of provision for depreciation and other capital charges, profit and additions to reserves.

"(ii) All beet contracts offered by farmers to be accepted by factories up to their throughput capacity as defined by the Minister of Agriculture and Fisheries, and the whole

of the contracts of each factory to be on the same terms as to price.

“(iii) The special advance to be contingent upon the price of sugar during the 1931-32 manufacturing campaign, that is to say, if the price of raw sugar (96°) rises above 6s. 6d. per cwt. c.i.f. United Kingdom, the amount of special advance promised shall be abated by the amount of the rise in sugar prices.

“About two-thirds of the factories have already accepted the Government’s proposal and have decided, in consequence, to offer farmers a price of 43s. per ton for beet of 17½ per cent. sugar content. At the moment I am unable to give the House any further information as to the results.”

* * * * *

SMUT diseases are responsible for very considerable loss of cereal grain in this country every year, bunt of wheat in particular being the cause of loss of many thousands of bushels annually. The damage done is to be measured, not only by the amount of grain actually destroyed, which is often very large, but also by the diminished value of the healthy grain, which becomes blackened and contaminated by the spores that adhere to its surface.

Cereal Smuts

Since it is possible, by fairly simple methods and at very moderate cost, either to avoid all loss caused by a given smut disease or to reduce the loss to a minimum, the Ministry has prepared a Bulletin* to guide farmers as to the means that are at their disposal to combat these troublesome diseases. Mention is made of the use of dry copper carbonate for the treatment of wheat against bunt, and it is suggested that this comparatively new method is worthy of extended trial. The diseases dealt with are bunt of wheat, loose smut of wheat, covered smut of barley, loose smut of barley, and covered and loose smuts of oats. The book is printed in clear type on good paper, and is well illustrated.

* * * * *

THE Ministry wishes to notify poultry farmers that it is now issuing a vaccine for Fowl Pox (avian diphtheria; diphtheritic roup; canker) at a charge of 1d. (one penny) per dose, to cover the cost of production. There will be a minimum charge of 2s. 6d. (two shillings and sixpence), this sum covering the supply of 30 doses of the

* Bulletin No. 24, *Cereal Smuts and Their Control*, price 5d., post free from the Ministry.

vaccine and an instrument and brush for its application.

The vaccine has been extensively tested in the field during the past 15 months; during that period, some hundreds of thousands of fowls have been inoculated, with very satisfactory results. The vaccine confers a solid immunity of at least four months' duration; it is free from danger; it causes no constitutional disturbance; and it does not interfere with egg production.

In order to keep down the cost of production and avoid unnecessary clerical work, *cash must be enclosed with each order*. Orders should be addressed to The Director, Ministry of Agriculture and Fisheries, Veterinary Laboratory, New Haw, Weybridge, Surrey. Cheques, money orders and postal orders should be made payable to "The Ministry of Agriculture and Fisheries" and crossed "Bank of England."

* * * * *

THE following note has been communicated by the National Institute of Agricultural Botany, Cambridge. Among potatoes,

Varieties of Potatoes

more than in the case of any other farm crop, the difficulty of making definite recommendations of varieties is very great.

This arises mainly from the confusion in naming which has existed until recent times. It would be quite impossible for any organization to test on a field scale all the so-called varieties which have been offered to the public. The Potato Synonym Committee of the National Institute of Agricultural Botany has, however, proved in the past few years that the number of genuine varieties—re-named again and again—is comparatively limited. Most of the *bona fide* potato varieties of commercial importance have been submitted to very accurate cropping tests by the Institute at its Potato Testing Station at Ormskirk, or, in co-operation, by the Agricultural Institute and Experimental Station at Kirton, near Boston, or by the Cornish County Council at Truro.

Potato growers should realize that whatever varieties they grow and however skilfully they may grow them, their efforts may be brought to naught by the use of unhealthy "seed." The best variety, if badly infected with virus diseases such as Leaf-roll or Mosaic, may give a poorer return than that obtained from healthy "seed" of an inferior variety. The best guarantee of health is to purchase only from firms of established reputation, and to refrain from planting "seed" grown in the south for more than two years.

Information concerning sprouting, manuring, spraying and

other cultural points is readily available to growers. It is, however, worthy of mention that the cutting of "seed," if carefully carried out, is an economy which has no deleterious effect on the crop; that 1½ oz. to 2 oz. "seed," whether cut or uncut, is the best; that the bigger the "seed" planted, the smaller the size of ware potatoes in the resultant crop.

To deal with individual classes of potato:—

Earlies.—The respective merits of the older varieties are well known and need no description; those to be recommended can be classified for time of maturity and order of yield as follows:—

<i>Earliest</i>	<i>Heaviest cropper</i>
Epicure	Epicure
Duke of York	{ Duke of York
May Queen	{ Eclipse
Sharpe's Express	{ Sharpe's Express
Eclipse	May Queen

These varieties deservedly retain their popularity with the public. In 1928, however, Arran Crest showed itself a serious competitor to Epicure; it proved to be seven days earlier, a somewhat heavier yielder, and as good or better as an early bulker. It is much the same shape as Epicure, but unlike the latter its skin never becomes tinted on exposure. These qualities, combined with the fact that it is immune from Wart Disease, make it well worth a trial where Epicure has hitherto been grown.

Another comparatively recent variety is Di-Vernon, a very distinctive purple mottled kidney type of about the same maturity as Epicure. It is immune from Wart Disease and is very early. Stocks of this variety are often severely affected with Mosaic disease, and it is not recommended unless healthy stocks can be guaranteed, and then for garden rather than for field cropping.

Second Earlies.—Many early maincrop varieties, such as Great Scot, Majestic, and Arran Banner (*see below*), can be grown as second earlies; the only true second early that the Institute's experience allows it to recommend is the old susceptible variety, British Queen.

Early Maincrops.—The more commendable varieties in this group can be classified as follows:—

<i>Earliest</i>	<i>Heaviest cropper</i>
Great Scot*	{ King Edward
King Edward	{ Majestic*
Majestic*	Great Scot*

As a new introduction, Arran Banner* is worthy of con-

* Immune from Wart Disease.

sideration as a substitute for Great Scot, though normally slightly later in maturity. The tubers are white, round, with medium eyes. It is a large cropper and heavy ware producer, and bulks sufficiently early to be grown as a second early. Owing to the large size of the tubers produced, the setts should not be planted more than 14 in. to 16 in. apart. The cooking quality is very fair and improves on keeping.

Late Maincrops.—The following are the best varieties in this group:—

<i>Earliest</i>	<i>Heaviest cropper</i>
Golden Wonder*	Kerr's Pink*
Arran Chief	Arran Chief
Kerr's Pink*	Golden Wonder*

Kerr's Pink is the heaviest cropper so far tested, though only fair in quality. Golden Wonder is an excellent cooking variety, but in general a poor yielder, largely owing to the fact that, until recently, all available stocks were severely infected with virus disease.

* * * * *

The National Institute of Agricultural Botany has made an examination of the potato sections of a representative selection

Potato
Synonyms

of the seedsmen's catalogues and lists
for 1931. Stocks of potatoes under many
of the names which appear in these
publications have been grown by the

National Institute of Agricultural Botany at the Potato Testing Station at Ormskirk in recent years, and have been adjudged by the Institute's Synonym Committee to be "synonymous" with well-known established varieties. It is gratifying to find that whereas, in 1930, 45 suspected synonyms were represented in these catalogues, no more than 28 have been found in the 1931 issues. It is too early to determine whether, in 1931, the varieties named below are again synonymous with the type varieties set against them, or with some other established variety, or whether they are, in fact, distinct. Prospective purchasers are advised to satisfy themselves by inquiry or guarantee that such varieties are distinct from, or are, indeed, of greater value than, their presumed types. Nor is a so-called "selected" or "improved stock" of an established variety, whether offered for sale under its original or under a new name, to be accepted as an improvement without evidence of adequate trial or sufficient guarantee.

<i>Type variety</i>	<i>Has had as synonyms in recent catalogues</i>
ABUNDANCE	Renown.
BISHOP	Advancer.
BRITISH QUEEN ..	English Beauty, Royalty.

* Immune from Wart Disease.

<i>Type variety</i>		<i>Has had as synonyms in recent catalogues</i>
DUKE OF YORK. . . .	..	Cherub, Chester Early, Victory.
(or Midlothian Early)		
ECLIPSE . . . .	..	Advancer, Colonist.
(or Sir John Llewelyn)		
GREAT SCOT . . . .	..	Dreadnought.
PRESIDENT . . . .	..	Scottish Farmer.
RED KING EDWARD . .	..	Cleadon Park, Mons Star.
ROYAL KIDNEY . . . .	..	Guardian, Queen Mary.
SHARPE'S EXPRESS . .	..	Earliest of All, Early Favourite, Express.
SHARPE'S VICTOR . . .	..	First Crop.
SNOWDROP . . . .	..	Witch Hill Early.
THE TOWSE . . . .	..	Mein's Chieftain.
UP-TO-DATE . . . .	..	Duchess of Cornwall, Factor, Long-keeper, Prosperity, Scottish Triumph, Sensation, Tremendous.

* * * * *

RETURNS recently received from University departments of agriculture, agricultural colleges and county farm institutes in England and Wales show that, notwithstanding the difficult times through which the farming industry is passing, the numbers of students at these institutions are

not only being maintained but in the majority of cases are on the increase. The students at present number nearly 2,200, an increase of about 120 compared with last year and 250 compared with five years ago. This is an encouraging sign of the optimism felt in some quarters for the future of agriculture.

It is true that the returns for one or two of the higher institutions reveal a decline in numbers. The students who would normally have gone to these institutions, however, have not been lost to the industry ; the Ministry has been informed that for financial reasons the students have entered less expensive colleges and the satisfactory returns for such colleges bear out this statement. The Faculty of Agriculture and Horticulture at Reading University leads the way with 248 students, an increase of 35 on last year's figure ; whilst the South-Eastern Agricultural College, Wyo, is continuing the success it has achieved in the past. The number of poultry students at the National Institute of Poultry Husbandry (at Harper Adams Agricultural College) is more than double the number for last year, and this is an indication of the growing importance of the poultry industry in the economic life of the nation, a lesson learned at the World's Poultry Congress in 1930.

In view of the increasing importance attaching to the part played by women in agriculture, it may be mentioned that the numbers of students at the two women's colleges at Studley

(Warwickshire) and Swanley (Kent) are being well maintained. All told, there are 538 women students at these and other agricultural institutions in England and Wales, an increase of 66 compared with last year.

Perhaps the most noteworthy feature of the present returns is the increase in the number of students attracted to the veterinary profession; this is especially interesting when regard is had to the vast national losses inflicted annually by animal diseases, and to the prominence which has recently been given to the future of the Royal Veterinary College at Camden Town. It is noteworthy that this old-established institution is finding it difficult to cope with the number of students entering. The position with regard to the Veterinary Department of Liverpool University is also satisfactory.

An analysis of the returns reveals that, of the 1,600 students attending the higher institutions, 889 are taking agricultural courses, 234 horticulture, 115 dairying, 75 poultry husbandry and 261 veterinary science. All these figures represent increases on those for last year. The duration of the courses taken by these students varies from one to four years.

There are nearly 600 students in attendance at the various county farm institutes throughout the country, where the courses of instruction are shorter and range from a few weeks to a year. Here again there is an increase on the figures for the previous year.

* * * * *

THE annual conference of the National Association of Young Farmers' Clubs took place at Montagu House on January 30, 1931. A large attendance of representa-

Young Farmers' Clubs : Annual Conference	tives of Young Farmers' Clubs, Local Agricultural Education Authorities and other bodies from all parts of the country met to consider the work of the Association
---	--

tion in 1930 and to discuss the programme for 1931.

Professor W. G. S. Adams presided, and at the afternoon session, in the absence, through illness, of Lord de la Warr, Sir Charles J. Howell Thomas, K.C.B., C.M.G., the Permanent Secretary of the Ministry, addressed the meeting. He referred to the part taken by the National Council of Social Service in accepting responsibility for the organization and furtherance of the movement, and to the steady progress which had been made during the past two years. There were now 108 clubs with a total membership of over 2,500 and the journal of the Association, *The Young Farmer*, had advanced its cir-

culatation during the past 12 months by nearly 100 per cent., to 2,000 copies monthly. Sir Charles made particular reference to the valuable assistance given to the movement by Local Authorities for Agricultural Education and to the response to an appeal for the help and co-operation of their technical and advisory services. The view of the Ministry was that the development of Young Farmers' Clubs was an important feature of the programme for rural agricultural education, and the Ministry would continue to assist and support the movement as far as lay in its power. The Government grants to the Association for the next three years were to be increased in order to give the organization every opportunity of becoming self-supporting, so far as State funds were concerned, by 1934. The grants proposed were as follows :—

<i>Direct grant</i>				<i>£ for £ grant in respect of funds raised by the Association from voluntary sources.</i>			
			£				£
1931	..	..	900	1931	..	..	700
1932	..	..	600	1932	..	..	800
1933	..	..	300	1933	..	..	900

Subsequent discussions by the Conference related to *The Young Farmer*, club progress and finance, and county co-operation between clubs.

* * * * *

PROGRESSIVE growers of crops under glass regard soil "sterilization" as a normal part of the year's work; they look on it as an insurance against loss from pests, and as a definite means of increasing soil productivity. It is true that at one time the process was thought an expensive luxury, but experiments made by Sir John Russell and his associates have clearly demonstrated its benefits.

Whatever advantages "sterilization" may claim, there is one question that is of first importance: "Does it pay in practice?" Proof that it does is given in a convincing manner by the increasing number of growers who "sterilize" regularly for this very reason. It must be emphasized, however, that "sterilization" must be thorough; half-hearted inefficient attempts will most likely waste money and give an entirely wrong idea of the possibilities of the process.

As the subject is of great importance to the industry, the Ministry invited Dr. Bewley, of the Cheshunt Experimental

* Bulletin No. 22, *Practical Soil Sterilization*, price 1s. 0d., post free from the Ministry.

and Research Station, to prepare a Bulletin describing the different methods in use and to show their relative values. As a result a new Bulletin* has been issued, in which the author gives a full and clear account of his subject. He avoids highly technical and scientific descriptions, and numerous illustrations assist in explaining the different types of apparatus. Methods of "sterilization" dependent upon steaming, baking, and chemicals are all described and assessed, and useful data relating to costs obtained from practical growers give point to Dr. Bewley's conclusions. The book itself is well produced in clear type on good paper and has an attractive wrapper.

* * * * *

ACCORDING to returns made to the Ministry by the beet-sugar factories operating in Great Britain, the total quantity of home-grown beet sugar manufactured during January, 1931, together with the quantity produced during the corresponding month

in 1930, was :—

					cwt.
January, 1931	..	..	..	..	1,380,916
January, 1930	..	..	..	..	467,760

The total quantities of sugar produced during the two manufacturing campaigns to the end of January were :—

					cwt.
1930-31	..	..	..	..	8,371,495
1929-30	..	..	..	..	5,799,529

* * * * *

THE monthly notes on feeding stuffs that have been a feature of this JOURNAL for some years past have attracted wide attention, and the Ministry has been indebted successively to the late Professor T. B. Wood, and to Mr. E. T. Halnan, Dr. Woodman and (recently) Dr. Sanders for providing them. The time has now come when Dr. Sanders has expressed the wish to relinquish the preparation of these notes, and as his last article of the series appears in this issue (p. 1261) the Ministry desires to place on record its thanks to him for the care he has devoted to them. In response to an invitation from the Ministry, Mr. W. A. Stewart, M.A., B.Sc., Principal of the Northamptonshire Farm Institute and Director of the Moulton Experimental Farm, has undertaken to contribute the notes on feeding stuffs for the next twelve months.

THE BLIND LOUSE OF THE HONEY-BEE

W. HERROD-HEMPSTALL, F.E.S.,

Ministry of Agriculture and Fisheries.

THE Blind Louse (*Braula coeca*) is a tiny, reddish-brown creature, whose habitat is on the body of the honey-bee. It is very prevalent in Europe and South Africa. In this country it makes its appearance in bee colonies spasmodically, i.e., no sign of it may be seen for a number of years; then, for several seasons in succession, it may be found infesting some colonies of bees in large numbers, but only in specific districts, and even then it is not widespread. It would appear that its activities are confined to the southern and midland counties of England since the writer has never found a specimen north of Nottinghamshire. It is a creature which has intrigued bee-keepers and entomologists in many countries. It was first mentioned in bee literature in 1740, and named by Nitzsch in 1818. In the year 1921, S. H. Skaife* fathomed its life history to a certain degree in South Africa. Previous to his researches, various, and, as we now know, erroneous, statements had been made about its life history.

The earlier theories advanced, apparently without the slightest attempt at verification, appeared to be so obviously correct that they were not questioned, but were quoted by subsequent writers as fact, and, like old women's tales, which lose nothing by repetition, the recorders frequently embellished the description with fantastic ideas of their own.

Boise stated that it is pupiparous and that the pupa is deposited in a cell containing a very young bee larva, where it reaches maturity in about twenty-one days. Packard asserted that almost immediately after the larva hatches from the egg, it sheds its skin and turns to an oval puparium, dark brown in colour. Cowan told us that "the eggs hatch inside the insect, and the larvae are nourished by the secretion from a gland. The pupa is extruded on to the floor-board of the hive; fourteen days later a perfect insect emerges. The young lice remain on the floor-board until they have the opportunity of climbing on to a passing bee."

Skaife, after describing the finding of tiny eggs on the cappings covering brood of bees, which he suspected were laid by *Braula coeca*, says: "A number of the lice were caught and carefully dissected under a binocular dissecting microscope. In three or four of the females examined, a fully formed

* *Transactions of the Royal Society of South Africa*, Vol. X, Part I, 1921.

egg was found in the ovarian duct, and these eggs were obviously identical with those found on the brood combs. The appearance, size, shape and markings were exactly identical, so that there could be no possible doubt as to their identity. Having thus established the fact that the bee louse is oviparous, and not pupiparous, as is so often stated, an endeavour was next made to trace out its life history."

He then describes how a queenless colony, having laying workers functioning, was discovered, the drones in which were badly infested with *Braula*, and goes on to say; "A number of the drone larvae were removed from their cells and examined under a lens. In several cases one, and in a few cases two, small dipterous larvae were found lying side by side with the bee larvae. The largest of these dipterous larvae measured 2 mm. in length. The buccopharyngeal armature, the tracheal system and all the sensory papillae of these larvae were exactly similar to those of the embryos found in the eggs of *Braula coeca*, hence there could be no doubt but that these were the larvae of the bee louse."

"Six puparia were brought to light after a prolonged search in the hive mentioned above, and all of these were found in sealed cells containing drone pupae. . . The adults had already emerged from four of the puparia when found, and these adults, pale yellowish white in colour, had made their way to the drone pupa inside the cells. The remaining two puparia were kept in order to watch the emergence of the adults, but unfortunately both died after their removal from the hive. The exit hole in the puparium consists of a rough tear and is apparently made by a ptilinum, for a well-marked ptilinal suture can be seen on the head of the adult."

Prof. A. G. Beliaevsky, of Novotcherkassk, Russia,* describes the results of his study of *Braula coeca*, and also gives drawings, copied from Skaife, together with photographs of the incidents. He says: "I found the eggs of *Braula coeca* exclusively on the wax sealings of honey, and only a small number of them in the wax dirt on the floor. The eggs were not distributed on the edges of the cell, but on the capping itself, and were stuck fairly firmly to the capping."

He also states that he found some live larvae of *Braula coeca* in tunnels under the capping, but did not discover anything further.

In 1928, the writer received complaints of damage done to comb honey in sections by some creature tunnelling in the

* *The Bee World*, June, 1929.

cappings. Investigation revealed similar conditions to those experienced in the apiary at Swanley Horticultural College, Kent, in 1899; indeed, the photographs in Fig. D were taken there in that year.

The late F. W. L. Sladen, when residing at Dover, noticed tunnels in the cappings covering honey in sections. Being anxious to discover the creature responsible for the damage, he made appeals to bee-keepers having such sections to send him the cappings. These appeals appeared in the *The British Bee Journal* for August 28, 1902, May 21, 1903 (together with photographs of the tunnels), and June 20, 1912. In the last year he described it as "The Comb Capping Maggot," because at that time he had found the maggot and stated as his opinion that it was "a dipterous larva, possible of the genus *Phora*." His research did not lead to any discovery beyond the maggot.

The writer therefore determined, if possible, to fathom the mystery, and after three years' research has succeeded in so doing. As will be seen from the following particulars, the culprit is *Braula coeca*.

Sladen's statement that he believed it to be a dipterous larva delayed the ultimate result, because for a long time an attempt was made, without success, to find the parents of the larva in the form of a typical, winged fly. This failure led to concentrating on attempts to breed out the larvae to the perfect insects. Methods too numerous to mention here were tried before success crowned the efforts in 1930, when they were bred out from portions of a comb, contained in petrie dishes, kept at hive temperature by placing them over a strong colony of bees. It had been previously discovered that the larvae quickly perish when exposed to a temperature below 98 deg. F.

The first objective was to find out all about the larva and its ways. To this end, portions of capping were cut from affected combs and placed on the alighting-board of a hive containing a strong colony, the inmates of which removed the honey and rendered the capping free from all stickiness in about three minutes, thus exposing the tubes made by the burrowing larvae. The portions of capping were then placed under a dissecting microscope, upside down, and the tunnels opened up with a very fine needle, as seen in the photo-micrograph Fig. A (No. 1). For some time only eggs were discovered, one of which may be seen in the same illustration indicated by an arrow; but eventually all the larval stages intervening

between the egg and the pupa were found as well as the puparium itself.

The skin of the larva, no matter what its age, is very delicate and easily ruptured. Right from its birth to the time when it changes into the pupal stage, the grub is able to travel along its tunnel as rapidly as does the larva of the wax moth in its burrow.

A typical piece of badly infested capping is presented in Fig. A (No. 2), showing, at 1, the egg; at 2, a small larva just emerged from the egg; at 3, a larva just before changing to a pupa; at 4, a puparium immediately it was formed; and at 5, a puparium on the verge of emerging.

NOTE.—In this picture may be seen another incident, unknown until now, and although not connected with *Bracula*, it is given as a matter of interest. It was found that after the bees cleaned the honey from the portions of infested capping as described, innumerable wax scales were left in the shallow cell cavities remaining attached to the capping, thus showing that during the work of secreting wax and storing honey many wax scales fall and enter the cells being filled with honey, from which they are not retrieved.

The egg is laid by the female *Bracula* on the inside edge of a cell filled with honey, and fastened by one end only, just previous to sealing over. It is bright white in colour, 0.75 mm. long and 0.45 mm. broad, and has a ragged fringed edge on either side. The photo-micrograph at Fig. B (No. 1) shows two eggs, the one on the right being a three-quarter view of a perfect specimen revealing the ragged fringed edge; that on the left had the outermost cover torn from one side, the inner covering hiding a dried-up embryo. The picture at Fig. B (No. 2) is of the same pair of eggs, but in this case the inner covering was removed from that on the left, thus revealing the dried-up embryo (dark mass).

The photo-micrograph Fig. B (No. 3) is of an egg-shell on the right fastened to an egg on the left containing an embryo, in which the shape of the buccopharyngeal armature shows clearly.

The larva emerges from the attached end of the egg, and evidently lives upon honey and pollen grains. As it progresses along the inner surface of the capping through the air-space which intervenes between it and the honey, it makes a tube or tunnel by breaking the wax of the cell walls into small fragments with the hooks of the buccopharyngeal armature, and converting the pieces thus severed into a mastic, which is impervious to honey, so that the interior of the tunnel remains quite dry. The end of the egg is secured to the wall of

the cell very firmly by a glutinous secretion ; therefore, after the larva comes forth, the vacated shell remains so fixed and thus prevents the percolation of honey into the tunnel. Immediately it hatches the larva measures 0.88 mm. long and 0.25 mm. broad ; the diameter of the tunnel is 0.30 mm. inside and 0.70 mm. outside, the wall being 0.2 mm. thick. When full grown, the larva measures 4.60 mm. long and 1.30 mm. broad, while the diameter of the tunnel is 1.80 mm. inside, and 2.5 mm. outside, the wall being 0.35 mm. thick. The larva now ceases to perambulate and rests in a *cul-de-sac* of the tunnel, where it changes into a puparium measuring 3.5 mm. long and 1.18 mm. broad.

When examined superficially, the cappings of an infested comb have the appearance of being intersected with fine fractures, but when such a comb is viewed against a strong light the tunnels are broad and quite distinct, similar to the burrow of the leaf miner.

During the early part of the work (*i.e.*, when looking for a fly) it was puzzling to find occasionally on the face of the comb, and following the traverse of the tunnelling, a tiny ridge of granular wax, similar to the earth uplifted by a mole when burrowing, as seen in Fig. A (No. 3), and having an occasional hole as at Fig. A (No. 4). This was at first thought to be the opening through which the creature escaped ; later investigations showed that it is merely a means of getting rid of excess material. As a rule, the tube follows the walls of the cells, but, occasionally, tunnels of different sizes may be found in a mass and intersecting each other, as at Fig A (No. 5). In such cases, as seen in the picture, the portion of the cell walls, accommodating the aforementioned air space, is entirely consumed within the affected area.

In the enlarged photo-micrograph of a fully developed larva, Fig. B (No. 4), the perfect buccopharyngeal armature is revealed, whilst the segments are clearly defined, as well as the knob-like sensory palpi at both the anterior and posterior ends, those at the former being the longest. If such a larva be placed on a glass slide under a microscope the observer will be astonished at the rapidity with which it is able to travel. At this stage of development the creature prepares for escape, when fully formed, by making an extremely fine circular cut, similar to the cut made by a diamond on glass, through the wall at the anterior end of its prison, by means of the hooks of the buccopharyngeal armature. This cutting is impossible when the animal reaches



FIG. A.

Copied by W. H. H. H. H. H. H.

THE BLAND LOUSE OF THE HONEY BEE

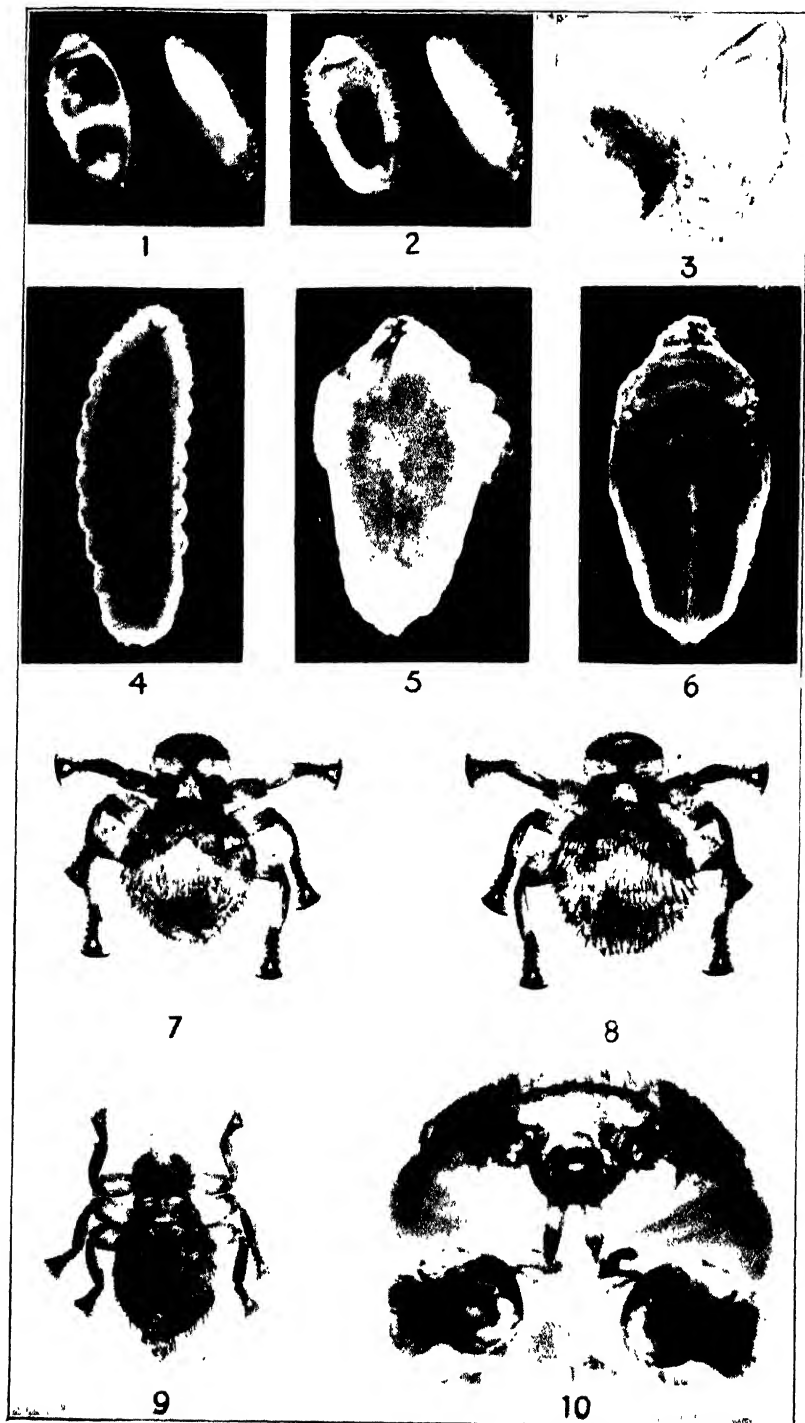


FIG. B.

Copyright: W. Herrod-Hempall

THE BLIND LOUSE OF THE HONEY BEE.

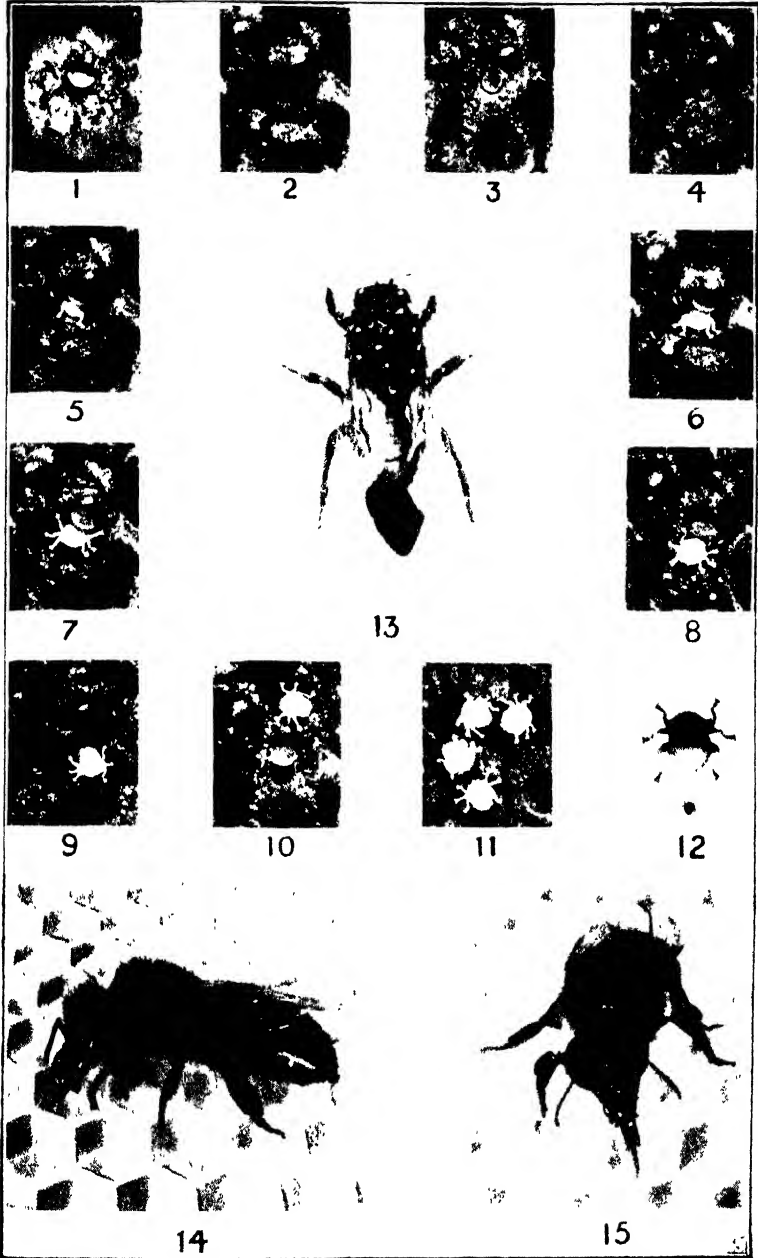


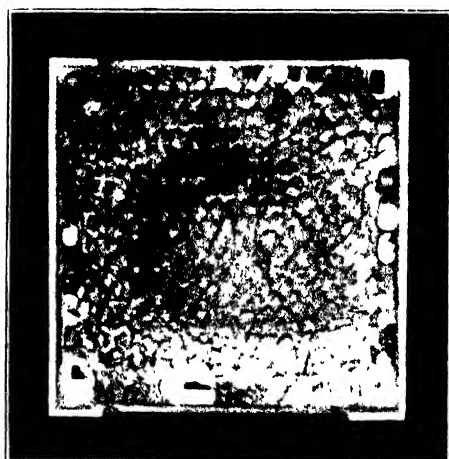
FIG. C

Copyright W. Herrod-Hempsall

THE BLIND LOUSE OF THE HONEY BEE.



1.



2.



3.

FIG. 1D.

Copyright, W. Herrold-Hempstall

THE BLIND LOUSE OF THE HONEY BEE.

maturity, because then, as will be shown later, it does not possess jaws, but only a round sucking mouth. It is a marvellous feat for the larva to make the above-mentioned clean incision without disturbing the encircled material in the least, when we consider that the substance penetrated is 0.24 to 0.25 mm. thick.

The photo-micrograph Fig. B (No. 5) shows a nymph in the first stage of that phase of its life in its pupal skin. The buccopharyngeal armature, now detached and useless, may be seen lying over the back of the developing head. At Fig. B (No. 6) the nymph was almost ready to emerge from its prison. Here, again, the buccopharyngeal armature, although not so distinct, may be seen lying over the back of the head, whilst the entire dorsal portion of the body, having the legs folded at the sides, is plainly visible through the enveloping pupal skin. The photograph of a puparium lying in position with its head towards the aforementioned lid to be, Fig. C (No. 1), was made possible by breaking away the surrounding wax capping.

In order to see the creature emerge, search must be made by means of a lens, at the end of well-defined tunnels, until a circular cut is discovered, as at Fig. C. (No. 2). Presently, often a very long presently, a slight movement of the encircling material may be seen. The creature inside has then made a tear in the frontal cap of the chrysalis case or puparium by inflating the ptilinus—a small bladder-like organ—which may be seen forced out at the apex of the head in the pressed adult specimen at Fig. B (No. 9). A well-defined ptilinal suture may be found on the head of the adult *Braula*. From now on, as recorded by the camera, the act of emerging is as follows:—At No. 3, in Fig. C, the cap, so as to speak, may be seen slightly raised; at No. 4, the two front feet were projected through the opening, to act as a lever while the creature forced its head upwards against the lid until it reached the position seen at No. 5. It then struggled forward until the second pair of legs were extricated from the cavity as at No. 6, and all three pairs free at No. 7. At No. 8, the point of the abdomen was just emerging from the hole; note the cap, raised like the hinged lid of a box when half open—similar to the manner in which the cap is left on a queen-cell after the princess has emerged. At No. 9, the creature had got a little farther, whilst, at No. 10, it had travelled to the back of the uplifted cap. The body of the adult, exclusive of the hairs and legs, measures 3.0 mm. long and 2.0 mm. broad. When the animal first escapes from its prison it is pearly-white in colour and almost

transparent. A curious feature is that the abdomen contains a large air-bubble; this may be observed as a light spot, through halation, in the photographs Nos. 9, 10 and 11.

The breeding season commences in May and closes towards the latter end of September. The time occupied in growth, from the egg to the perfect insect, is twenty-one days.

It was found that when the *Braulæ* emerged from the comb in the petrie dishes, which, of course, did not contain any bees, they displayed a social trait by collecting together on the most elevated position of the comb, as did the four at Fig. C (No. 11). Moreover, whether singly or in groups, they remained motionless for long periods. On a number of occasions, for half an hour at a time, close watching failed to reveal even the slightest tremor of the body.

It would appear that the mature insect cannot live on honey from the cells, because it was found that the duration of life never exceeded six hours after emerging from the comb in the petrie dishes isolated from bees. When bees were introduced, the *Braulæ* quickly ran to and climbed on to the body of the host by way of the legs. In such cases the *Braulæ* compelled the bees to feed them and so lived on. It was observed that the colour of the body gradually changes from white to the permanent reddish brown. The coloration commences at the head and gradually spreads to the posterior extremity. The extent of the coloration at the end of eight hours is shown by the specimen in Fig. C (No. 12), and is fully completed in twelve hours. The photograph of the insect, actual size, is also shown in this illustration for comparison with the enlargement.

The photo-micrographs at Fig. B (Nos. 7 and 8) are interesting, because this was the first *Braula* ever bred in captivity. The specimen is a male and the genital organ may be seen in the illustration at No. 7, which shows the ventral side, whilst No. 8 gives a dorsal view. The female is shown at No. 9, where also the genital organ may be seen.

Braula coeca infests the body of the worker and the queen, but is rarely found upon the drone. As a rule, not more than two specimens are present on the body of a worker at one and the same time, but the body of the queen in an infested colony frequently assumes the appearance of being covered with barnacles, especially the thorax, as was that shown in Fig. C (No. 13), from which were removed twenty-six *Braulæ*; this photograph was taken in 1899. The creature is able to move very quickly, and migrates from one host to another by a

jump so rapid that the passing is almost imperceptible. It travels over the body of the bee when disturbed, but its favourite hiding place on the worker is in the joint between the abdomen and thorax, or round the neck, and when so located it is very difficult to see. Moreover, it is not an easy matter to detach it alive from a host with an instrument, because each foot is furnished with hooks and a powerful sucking pad or pulvillus, as seen in Fig. D (No. 1). In fact, so tenacious is its hold, that, when the body is gripping and pulled with forceps, some of the legs frequently come asunder.

It was supposed at one time that the relation of *Braula coeca* to the honey-bee was parasitic, and that it pierced the flexible joints of the armour and sucked the blood of its host. This, however, is not the case, for, as already indicated, the creature does not possess jaws, but only a round, sucking mouth. This organ is shown in the enlarged photo-micrograph Fig. B (No. 10), as well as the four labial palpi; the insertion of the anterior pair of legs to the body may be observed on either side in the lowest portion of the picture.

Instead of being a parasite, *Braula coeca* is commensal, i.e., it feeds with, and not on, the bee. The method by which the creature obtains its food may be observed by placing infested worker bees in a glass tube about $1\frac{1}{4}$ in. in diameter, fitted with a floor of partly built comb or comb foundation to give them a foothold. It will be seen that, when needing food, the creature leaves its hiding place in the waist or neck, walks to the face of its host and sits on the jaws; then, either by tickling the upper lip of the bee or by some other means, compels it to extrude its tongue, from which the *Braula* takes its fill of food and then departs whence it came. Immediately a *Braula* reaches the face of a bee intent on food, the latter stands stock still, and does not attempt to walk until its unwelcome companion departs from that position. The incident of feeding is shown by the photographs in Fig. C (No. 14, side view and No. 15, facial view); in No. 15, a second *Braula* may be seen perched on the right foreleg of the bee.

Braula coeca does not find the bee a willing commissariat department, for the host tries to rid herself of the unwelcome guest by scraping it away with her legs, but eventually gives in and supplies the food demanded. The whole business is reminiscent of that seen to take place when ants obtain food from heavily laden bees that fall short of the alighting board, and land upon the concrete slab supporting the hive. Such bees stand still for a while to rest, and whilst

so doing an ant concentrates on an individual bee, and runs round and round her until she extends her tongue and allows her tormentor to feed from it.

Braula coeca is supposed to perish in this country during the winter, and its presence from year to year is attributed to importation on the bees arriving from more sunny climes, such as Italy. That it survives the winter here may be regarded as certain. As evidence that such is the case, experimental colonies examined on January 25, 1931, were found to contain *Braula coeca* still infesting the bees.

Usually the pest has been exonerated from being the cause of any mischief in connexion with apiculture, other than irritating the worker bees, and, through its partiality for the body of the queen, preventing her from carrying out her duty of egg-laying comfortably and efficiently. From the foregoing, it will be realized that the tunnels made by the larvae in the cappings of comb honey give it such an unpleasant appearance as to render it unsaleable. The illustration at Fig. D (No. 2) shows the distasteful appearance of a section of comb honey so damaged, whilst an enlargement of the same tunnels is presented at Fig. D (No. 3). Moreover, apart from the defect described above, the capping is rendered so weak at the sides of the burrows that, when removed from the colony, the honey absorbs atmospheric moisture, becomes thin, and quickly percolates through and trickles over the face of the comb and utterly ruins it.

The writer has found that tobacco smoke is fatal to *Braula coeca* in from one to two minutes. If an infested queen is held in the closedh and, and tobacco smoke is driven in from the mouth, the above assertion will be quickly proved correct, for all the creatures fall away dead or dying. Therefore, the means whereby an infested colony may be freed from the pest is obvious, i.e., by driving tobacco smoke into their home, when the asphyxiated *Braula* falls to the floor-board. To make matters safe, it is just as well to remove the brood chamber and brush the floor-board clean, to remove any which might by chance recover.

The writer desires to tender his thanks to Mrs. C. Barrow Simonds, Miss M. M. Taylor, Messrs. H. P. Young, H. Priddis and A. Parrington for their kindness in supplying affected material for the purpose of this research; and to Mr. J. Page for taking the photo-micrographs shown in Fig. B.

THE CONTROL OF THE COMMON GREEN CAPSID BUG ON RED CURRANTS

F. R. PETHERBRIDGE, M.A., and G. L. HEY, B.A.,

School of Agriculture, Cambridge.

UNTIL recent years, the capsid most commonly found damaging red and black currants was the Apple Capsid Bug (*Plesiocoris rugicollis*), and this pest still causes damage in some plantations. Latterly, however, the Common Green Capsid Bug (*Lygus pabulinus*)* has been responsible for serious damage to red and black currants, to gooseberries, and to strawberries interplanted with these crops; so that this insect, which is found all over England, is now regarded as one of the more important pests of bush fruits.

In 1929, in some experiments carried out near Wisbech,† a proprietary mineral oil emulsion, used at 7 per cent. concentration, applied on March 6, gave a fairly good control of the Apple Capsid Bug, a rather better control than that obtained by the use of a proprietary "Modified Long Ashton" type wash at a strength of 12 per cent.

The experiments here described were designed, therefore, to test the comparative values of mineral oil emulsions and the "Long Ashton" type wash for the purpose of killing the eggs of *L. pabulinus*. Two plantations at Cottenham, Cambs., about a quarter of a mile apart and belonging to different growers, were chosen for the experiments.

Experiment A.—The plantation consisted of three rows of old bushes of Fay's Prolific red currant which had received very little pruning and were, consequently, rather thick. The bushes were in the middle of an orchard, with mixed plums and apples on either side. The washes were applied on February 26, 1930, by means of a barrow-type, hand-power machine, the nozzle being adjusted to give a moderately coarse spray. *Soft water* was used for mixing the washes. The bushes were dry, the weather mild and the wind slight. About half-a-gallon of wash was used per bush, but less of the "Long Ashton" wash was required to cover a bush than of the mineral oil emulsions, the former being much easier to see on the bushes.

Each plot consisted of about twenty bushes and the application of the washes, and their strengths, were as follows:—

Plot 1: Mineral Oil Emulsion A, 7½ per cent.

Plot 2: Control.

* The life history of *L. pabulinus*, and the damage caused by it, are described by Petherbridge and Thorpe, see *Ann. App. Biol.*, Vol. XV, No. 13, 1928.

† By F. R. Petherbridge and W. G. Kent, see this JOURNAL, February, 1931, p. 1078.

- Plot 3: Mineral Oil Emulsion B, $7\frac{1}{2}$ per cent.
 Plot 4: Control.
 Plot 5: "Long Ashton" wash, 10 per cent.
 Plot 6: Control.
 Plot 7: Mineral Oil Emulsion B, $7\frac{1}{2}$ per cent.
 Plot 8: Mineral Oil Emulsion A, $7\frac{1}{2}$ per cent.
 Plot 9: Control.
 Plot 10: "Long Ashton" wash, 10 per cent.

When the buds had opened in April, it was noticed that the "Long Ashton" wash had injured a few of the buds and had retarded the opening of the others. In June, there were obvious differences in the amount of capsid markings on the various plots. The whole of the capsid damage on these bushes was due to *L. pabulinus*, as *P. rugicollis* was not found.

Results.—On July 8, the number of marked shoots, and the total number of shoots on the bushes of two of the three rows, were counted, and in this way the percentage of marked shoots on each plot was obtained. It is noteworthy that there was practically no migration from one plot to another, probably on account of the abundance of weed hosts. The results obtained are shown in Table I.

TABLE I.—EXPERIMENT A: COTTENHAM, CAMBS, 1930

Plot	Treatment sprayed on February 26	Percentage of marked shoots
2 } 4 } 6 } 9 }	Control	{ 72.6 59.3 60.7 68.4
5 } 10 }	"Long Ashton" wash, 10 per cent.	{ 48.5 58.8
1 } 8 }	Mineral Oil Emulsion A, $7\frac{1}{2}$ per cent.	{ 27.7 11.2
3 } 7 }	Mineral Oil Emulsion B, $7\frac{1}{2}$ per cent.	{ 10.1 8.1 (= 8.0)

Experiment B.—The plantation consisted of 24 rows, each with about 15 bushes of young red currants (variety unknown) interplanted with young bush apple trees. The washes were applied on February 26 as in Experiment A, but, in this case, hard water from a well at the edge of the plantation was used. About 6 gal. of wash was used for each row of 15 bushes.

There was a certain amount of oil separation from the "Long Ashton" wash. No damage to the bushes was noticed.

Each plot consisted of two rows and each treatment was applied to two plots. The sprayed plots were separated by unsprayed plots. *P. rugicollis* was not found on these bushes.

The results obtained are shown in Table II:—

TABLE II.—EXPERIMENT B: COTTENHAM, CAMBS, 1930

Plot	Treatment sprayed on February 26	Percentage of shoots marked
4 } 10 }	Control	{ 57.4 { 55.4
1 } 7 }	"Long Ashton" wash, 10 per cent.	{ 48.9 { 57.5
3 } 9 }	Mineral Oil Emulsion A, 7½ per cent.	{ 7.9 { 23.1
5 } 11 }	Mineral Oil Emulsion B, 7½ per cent.	{ 2.4 { 3.8

From the above results, it will be seen that one mineral oil emulsion gave a good commercial control of *L. pabulinus*, whereas another mineral oil emulsion has only given a moderate control.

"Long Ashton" wash, at a strength of 10 per cent., gave very little control of *L. pabulinus* in the above experiments, and in one of them killed a few of the buds.

In experiments, carried out by Staniland and Walton on Black Currants,* "Long Ashton" wash at a strength of 10 per cent., applied February 5, 1930, reduced the damage due to *L. pabulinus* and *P. rugicollis* from 30 per cent. to 10 per cent., whereas with a new wash, consisting of an emulsion of equal parts of a high-boiling neutral tar oil and a heavy paraffin, applied at the same time, they obtained almost a complete control of these bugs without causing any injury to the bushes.

Injuries to Fruit Bushes caused by Winter Spraying.—In some experiments carried out at Bluntisham, in collaboration with Mr. F. Tunnington, serious damage was caused to gooseberries, and some damage to red currants, by winter spraying with the above washes. The spraying was done on January 24, 1930, by means of a barrow-type machine and a fairly coarse nozzle.

The mineral oil emulsion A caused no damage when applied alone at 7½ per cent., but when a mixture of 7½ per cent. mineral oil emulsion A with 7½ per cent. "Long Ashton" wash was used, the whole of the fruit buds on the gooseberry bushes were killed. Later on, adventitious buds formed, which, on opening, developed small abnormal leaves, and the bushes appeared to be damaged apart from the loss of crop.

* See this JOURNAL, August, 1930, p. 475.

With red currants the damage from this mixture was not nearly so severe and was very variable. Some of the bushes suffered very little, on others some of the fruit buds were killed, and, on a few, occasional branches were also killed.

The "Long Ashton" wash applied at 10 per cent. killed a number of the gooseberry fruit buds and also a few of the red currant fruit buds. When applied at 12½ per cent., the damage was rather worse, but not as bad as that caused by the mixed wash.

This possibility of the damage to bush fruit (and also to strawberries) must be borne in mind when planning the spraying for top trees which are underplanted.

THE ESTABLISHMENT OF GRASSES ON VERY ACID MOORLAND

R. B. DAWSON, M.Sc., F.L.S., and T. W. EVANS, Ph.D., A.I.C.,
*Board of Greenkeeping Research, St. Ives Research Station,
Bingley, Yorks.*

ONE of the many problems confronting agriculturists, at the present time, is the conversion of poor grade pastures into better grazing land, with a consequent increase in stock-carrying capacity.

The work of Professor Stapledon and his staff at the Welsh Plant Breeding Station has clearly shown that this can be accomplished by correct manuring and judicious grazing. On very acid moorland soils, however, the problem is not one of conversion so much as renovation. The problem therefore resolves itself into the compounding of a seeds mixture which will result in a good "take" with the minimum expenditure on fertilizers previous to sowing.

The writers, although not directly associated with agricultural practice, were confronted with this difficulty when asked to prescribe a suitable fairway seeds mixture for a golf course which was to be constructed on a typical moorland soil near Bingley. The elevation of the area in question is 900 feet, and the rainfall on the estate, over the past 30 years, averages 36 in.—extremes, 46 in. and 25 in.

The soil was of an acid and peaty nature, overlying Millstone Grit, the dominant vegetation being heather. To obtain some information on the germinating capacity of various grasses under such extremely acid conditions, the experiment here noted was laid down, and the results obtained were so striking

that they are considered worthy of putting on record for the use of those concerned with renovating soils of this kind.

An area of 90 sq. yd. was marked off for the purpose of the investigation, and subsequently divided into 18 plots of 5 sq. yd. each. The plots were arranged in three traverses as shown in the diagram below :—

Plots			1	2	3	4	5	6
Traverse A
Traverse B
Traverse C

Traverse A did not receive lime ; traverse B received $\frac{1}{2}$ lb. ground carbonate of lime per sq. yd. (i.e., rather more than 1 ton per acre) ; and traverse C had 4 lb. per sq. yd., equivalent to just over $8\frac{1}{2}$ tons per acre.

The lime was applied on September 12, 1929, four days before sowing the seed. The following grasses (mostly acidophiles) or mixtures were used :—

Plot 1	Plot 2	Plot 3
Wavy Hair Grass (<i>Aira</i> [<i>Deschampsia</i>] <i>flexuosa</i>)	<i>Poa pratensis</i>	South German Mixed Bent (<i>Agrostis</i> spp.)
Plot 4	Plot 5	Plot 6
Hard Fescue (3 parts) South German Mixed Bent (1 part)	Hard Fescue	Sheeps Fescue Clover (Wild White) Yarrow Plantain (<i>P. lanceo-</i> <i>lata</i>) <i>Poa annua</i> Timothy

The mixture sown on Plot 4 will probably appear strange to the agriculturist, but it must be remembered that the Research Station at Bingley is concerned primarily with only one aspect of grassland husbandry, namely, turf culture. The question of weed control and infestation on acid soils is one of considerable interest, and the mixture sown on Plot 6 was intended to throw light on the effect of high soil-acidity on germination of certain weeds and meadow grasses.

All the plots were sown at the rate of 2 oz. per sq. yd. with the exception of Plot I, which was sown at double this rate on account of the very low percentage germination of the commercial *Aira flexuosa* seed. Again, this rate of sowing will probably appear heavy to the agriculturist, but it must be

remembered that this is the usual rate of seeding for putting greens, and is about twice the full economic rate for fairways.

All the plots were first examined on October 1, following rain on September 29, 1929, and notes taken on the amount of germination on each plot.

On the three *Aira flexuosa* plots there was slight germination, the unlimed plot showing up best. In all other cases, germination was very poor on the unlimed traverse, but where both heavy and light applications of lime had been given there was satisfactory germination. On this date the clover had not germinated on the unlimed part of Plot 6, but was starting well on the limed sections. At this time as judged by Universal Soil Indicator the pH* of traverse A was 4.0, of B 7.0, and of C 8.0, this being on the top 2-3 inches. Below this depth no effect of lime was detected.

A second examination of the plots was made ten days later (i.e., one month from sowing). On traverse A (not limed) germination of *Poa pratensis* and German bent was bad and hard fescue fair. *Aira flexuosa* was still backward, though slightly better here than on the limed traverses. A few clover seedlings were found on Plot 6, but no plantain or yarrow.

On both traverses B and C, which received lime, germination was vastly different from traverse A. In all cases except *Aira*, the effect of lime was very obvious in bringing about better germination, but it was noticed that heavy liming gave a germination only slightly better than light lime. Plantain and yarrow came up on the limed plots and there was evidence in the case of *Aira flexuosa* that actually lime had a slight depressing influence on the germination.

In the next few months any seedlings produced on the unlimed traverse withered and died with the exception of the *Aira flexuosa*.

After twelve months the differences between limed and unlimed parts was remarkable and the photographs (Figs. 1 and 2) taken on October 7, 1930, serve to illustrate this, and they show very strikingly that *Aira flexuosa* was the only grass able to germinate and persist without the previous application of lime. There are indications also that this grass flourishes better in unlimed soil than limed. The unlimed plot, sown with *Aira flexuosa*, produced a good turf, but all other unlimed plots were complete failures.

* A scale for measuring acidity. The neutral figure is 7.2. Lower figures (from neutral downwards) indicate progressive degrees of acidity; higher figures (from neutral upwards) indicate progressive degrees of alkalinity.

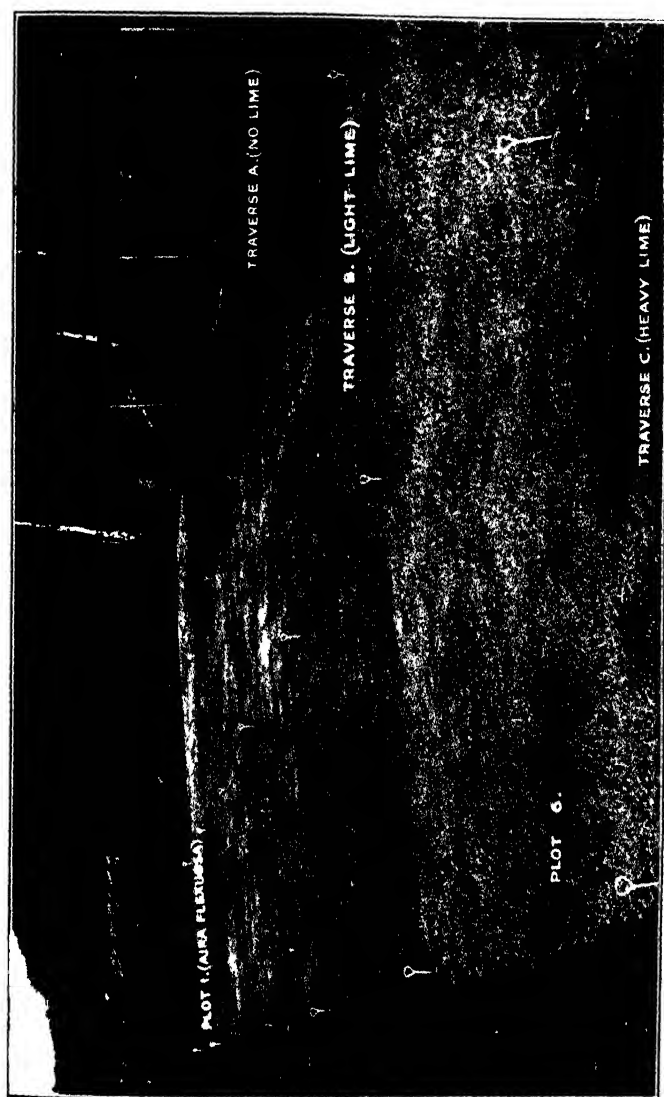


FIG. 1. Traverse A (no lime). Note failure of all plots except Plot 1 (*Virg. Fletcher*). Plot 1 (background) sown with *Virg. Fletcher*. Plot 6 (foreground) sown with *Poa annua*, Timothy, Fescue, etc. Note equality of Traverses B. and C. (light and heavy lime).

THE ESTABLISHMENT OF GRASSES ON VIRGY ACID MOORLAND



FIG. 2. Traverse A. Note texture of all plots except *Aira flexuosa* in foreground, which is established as well on the unfined as on the lined parts. Note similarity of Traverses A and C. Small light objects in foreground are leaves.

THE ESTABLISHMENT OF GRASSES ON VERY ACID MOORLAND

The investigation also indicated, in spite of a slightly poorer germination on the light-limed traverse, as against the heavy, that after a lapse of twelve months, or even less, no distinction could be made between the swards. It remains to be seen whether this apparent equality will be preserved over a number of seasons, or whether supplementary dressings of lime will be necessary.

The pH of each traverse, sampled to a depth of 3 in., was colorimetrically tested after twelve months (at the time the photographs were taken) with results as follows :—

Traverse A = 4.3 B = 4.5 C = 7.8

It should be explained that the whole experiment was duplicated on a slightly less acid woodland soil with substantially similar results.

The tentative conclusion may be drawn from these preliminary investigations that grasses, which will not establish themselves in this acid moorland soil, only require sufficient lime to help them over the germination period. Whether this is due to the temporary reduction of the acidity, or to the release of nutrient materials available to the seedlings, remains to be demonstrated by further experiments.

The lime requirement of this moorland soil, as determined by the Hutchinson McLennan method, is seven tons of ground carbonate of lime per acre, which is much in excess of the amount found necessary in these experiments to obtain satisfactory establishments.

In view of the tremendous expense incurred in liming highly acid soils at the present day, it would seem that additional experiments to investigate the minimum amount of lime or fertilizer (*e.g.*, clay) necessary to produce a "take" might prove fruitful. With this object in view, further experiments are to be conducted, not only with the above grasses but also with species more commonly employed in agricultural practice.

WEEDS OF GRASS LAND—IV*

H. C. LONG, B.Sc. (Edin.),

Ministry of Agriculture and Fisheries.

Dyer's Green-Weed (*Genista tinctoria* L.) is a perennial plant 1 to 2 ft. in height, branched and shrubby, with smooth spineless branches, entire ovate-lanceolate leaves $\frac{1}{2}$ to 1 in. long, and, for the size of the plant, rather large yellow flowers, somewhat like those of broom or gorse, in long racemes. The flowers appear in July to December (Fig. 1).

This plant was formerly used as a yellow dye, and it is possible that it was the *planta genista* that formed the badge of the Plantagenets.

This weed is in some districts a serious trouble in grass land, especially on clay pastures. Stock do not usually appear to touch it, but it has been observed that "cows will sometimes eat this plant, and it communicates an unpleasant bitterness to their milk, and even to the butter and cheese made from it."† Knapp‡ states that dyer's greenweed "is seldom eaten by cattle except in cases of great necessity, and remains untouched if other food be obtainable."

This species should be cut regularly to prevent seeding, or it may spread very rapidly. Cutting, in association with sound manuring—including a dressing of 6 to 10 cwt. of basic slag per acre—and judicious grazing may be expected to check it.

Rest Harrow or Wild Liquorice (*Ononis spinosa* L.) is a viscid, hairy perennial, with erect shrubby stems 1 to 2 ft. high, narrow, oblong toothed leaflets, and handsome rosy-pink, vetch-like flowers, appearing singly in the axil of the leaves or in leafy racemes (Fig. 2). The plant is generally spinous, and among hay, old dry plants have been mistaken for seedling gooseberries. Another species, *O. repens* L., possesses runners, is usually spineless, and has a strong, disagreeable scent.

Rest Harrow is in some localities a very harmful pest in pastures on poor heavy land, and some forms of it also on dry, sandy, and gravelly soils. It may occur in quantity, and is regarded as an indicator of poor soils.

If this weed is plentiful it must be attacked by thorough and regular cutting, liming, complete manuring, and close

* The earlier articles appeared in December, 1930 (p. 871), January, 1931 (p. 985) and February, 1931 (p. 1107).

† Johnson and Sowerby, *Useful Plants of Great Britain*, p. 69.

‡ *Journal of a Naturalist*, 1829, p. 76.

depasturing with stock. In bad cases it may be necessary to plough up the pasture, give a thorough cleaning and manuring, and again lay down to grass.

The Beaked Parsleys or Chervils (*Anthriscus vulgaris* Pers. and *A. sylvestris* Hoffm.) are common weeds on practically all soils, on hedge banks, by roadsides, and encroaching on grass land from hedgerows and waste land. The former species (Fig. 3) is an annual, 2 to 3 ft. high, branched and leafy, with tripinnate leaves; the minute white flowers appear in May to June, in umbels which grow from the side of the stem, on rather short stalks opposite the leaves. The small fruits bear hooked bristles.

Wild Chervil (*A. sylvestris*), on the other hand, is a perennial, flowering from April to June. The umbels of white flowers are terminal (Fig. 4) and the fruits smooth.

Where these two plants are plentiful they should be cut regularly before seeding takes place, a plan which soon materially reduces them, for both are spread by seed. It has been stated that the growth of *A. sylvestris* is greatly promoted by nitrate of soda, and the use of this manure should therefore be limited where the plant occurs. Mineral fertilizers, however, especially in conjunction with sulphate of ammonia, promote the growth of clover and grasses, which help to choke out the weed; superphosphate and kainit may be applied at the rate of 2 to 3 cwt. each per acre. If the weeds occur in meadows, the grass should be cut for hay as early as possible. In pastures the mowing machine may be used when necessary to cut patches that may appear.

Cow Parsnip, Hogweed (*Heracleum sphondylium* L.), is a common and well-known perennial weed, which frequently attains a large size (3 to 6 ft. in height). It is a rough, hairy, stout plant, with hollow stems and large leaves (1 to 3 ft.), much less lobed and divided than most plants of the order. The leaves have large pale sheathing bases. The flowers, which appear in July, are white or pink, the outer ones of the umbel irregular, one or more petals being considerably enlarged. Hogweed is not poisonous, like hemlock, and cattle eat it with impunity; tame rabbits are regularly fed on it. It is common on hedge banks, roadsides, waste places, and may encroach on pastures. Where it occurs it may be reduced by regular cutting, the mowing machine being used if the weed extends to large areas. At the same time, the need for liming, manuring and thorough grazing is indicated if the weed is plentiful.

Knapweed (*Centaurea nigra* L.), known under a variety of names, as Hardheads, Hardhack, Black-head, is a perennial plant, with a slender, grooved, usually branched and upright stem, with scattered variable hairy leaves, the upper ones narrow and tapering. The small purple flowers appear from June to October, grouped together in dense globose heads of about 1 in. in diameter, hard and black or dark brown. The heads are not prickly, but roughish.

Knapweed is too common in pastures and meadows, and is occasionally present on lawns, occurring especially on clays, loams, and calcareous soils, particularly if in poor condition. It is chiefly harmful on account of the fact that it is a useless plant, with tough, hard stems that are avoided by stock, although the young leaves are readily eaten by cattle and sheep. If allowed to seed it may spread rapidly and becomes very troublesome, rendering pastures unsightly, and usurping space that should be occupied by better herbage.

On small areas knapweed may sometimes be readily pulled up by hand during wet weather, but as the root system is large and the plant perennial, pieces are often left in the soil to grow again. On large areas the best method of dealing with the weed is to cut it early to prevent seeding, manure the land to encourage better vegetation, and ensure sound grazing.

In the first year complete artificials should be given, further applications following as may be required. If farmyard manure is available, a dressing might be given in the second season instead of artificials. On heavy land basic slag should be employed rather than superphosphate. If such treatment is persisted in, grasses and clovers are likely to become improved and vigorous, when the knapweed will be choked out.

The Ox-Eye Daisy (*Chrysanthemum leucanthemum* L.), sometimes called "Dog Daisy," is an erect perennial with branched stems bearing large white daisy-like flowers, 1 to 2 in. across; the flowers open from June to August. Like knapweed, it is most common in grass land in poor condition, especially on clays and calcareous loams. The general treatment recommended against knapweed is applicable in the case of the ox-eye daisy; and improvement in the condition of the land has the effect of greatly diminishing it. It is significant that in Canada the ox-eye daisy is called "poverty weed." The use of salt has been recommended in the United States. As the seeds of this weed may be found in grass seeds, it is necessary again to advise the use of only pure seeds.

The Dandelion (*Taraxacum officinale* Wigg. or *Leontodon taraxacum* L.) is one of the commonest weeds of grass land and needs little description. If a dandelion plant be examined it will be observed that the dense mass of leaves lies almost flat on the ground, covers comparatively a large area, and tends to smother out good grasses and clovers. The dandelion does more harm in this way than is commonly believed, and is sometimes present in immense quantity (Fig. 5).

Flowering takes place from early spring until the autumn, *i.e.*, from March to October, and if the flowers are allowed to come to maturity large numbers of seeds are produced and distributed by the wind by means of the pappus attachment. The writer has a record of a plant bearing twenty-seven flowering heads, one of which bore 200 seeds, indicating a total of 5,400 seeds on a single plant.

The dandelion possess very deep-seated roots, and as it is a perennial, and the leaves also lie very close to the ground, it is very difficult to eradicate, since it is usually proof against both mowing and spudding—and, indeed, it is often far too plentiful to make spudding a practicable proposition. In general, the most useful means of reducing dandelions is to apply a complete manurial dressing to encourage a better type of herbage; this does much to suppress the weed. Sulphate of ammonia is believed to be particularly helpful against the dandelion. (A pinch of sulphate of ammonia placed on the cut surface of each plant after spudding will kill the roots, but this is too tedious and expensive a process, except in the case of small areas, especially lawns.) Experiments conducted by Dr. A. B. Frank some thirty years ago showed that when dandelions were sprayed when full grown on June 20 with a 15 per cent. solution of sulphate of iron (60 lb. in 40 gallons of water) they became quite black and were killed. As grasses are but little damaged by such a solution, this method might be tried where dandelions are specially plentiful. Experiments conducted at about the same period in both the United States and Germany also showed that a 5 per cent. solution of copper sulphate, applied as a spray at a rate of 160 gallons per acre, largely destroyed the leaves and flowering stems of dandelions, preventing them from seeding. Photographs of the College lawns at North Dakota Agricultural College taken before and after spraying with copper sulphate in 1907 showed the effects very clearly. If such a method is to be tried, a small plot should be treated first as an experiment, to test the effect under local conditions.

The Common Rushes (*Juncus effusus* L., *J. inflexus* L., *J. conglomeratus* L., and various other species) are very plentiful in water meadows, damp meadows by streams and rivers, and similar situations. They are in general perennial plants, with an extensive and deep-seated creeping rootstock, erect, simple, pointed stems containing pith, and leaves that may be slender and flat, or round, resembling the stem. The flowers are brownish or green, somewhat star-like, and in axillary or terminal cymes or clusters (Fig. 6).

Rushes generally occur in damp, sour soils, and even when the surface appears fairly dry their presence usually indicates a wet subsoil, possibly some feet down. The most rapidly effective plan for getting rid of rushes is to ensure that the drainage is good, and that acidity is countered, but frequent close mowing is likely to prove helpful in reducing them considerably. Draining and liming in conjunction with manuring and mowing before seeding will destroy them. It is probable that a dressing of phosphate and finely ground kainit would have a very valuable effect in improving the herbage and reducing the rushes. It is well to run the mower over the patches again before winter, and mechanical treatment with heavy harrows may be useful.

As with cotton grasses and certain sedges, drainage is of prime importance, but the cost of the work is the great stumbling block. If drainage is slow or inadequate, as on many heavy soils, water tends to accumulate in the furrows and encourages rushes and water-loving plants. Improvement by combined liming, manuring, and grazing leads to a more open texture, an increase in clovers, readier drainage and aeration, better utilization of the moisture by the herbage on the ridges, a quicker absorption of the water, and closer grazing. The result is a real and lasting general improvement of the pasture, with greater stock-carrying capacity. This has been demonstrated at Cockle Park, and has been found true by practical farmers. Indeed, at this centre a dressing of basic slag only has resulted in such a change in the turf—previously impervious to rainfall—that it has become open and absorbent, is consequently better grown, more thoroughly grazed, and the rushes have largely disappeared.

Wood Rushes (*Luzula* spp.).—A number of species of *Luzula* are spoken of generally as Wood Rushes on account of their frequent occurrence in thickets, woods, and shady places. Some of them, however, are found on poor open pastures and heaths. One of the latter type is *Luzula campestris* Willd., a

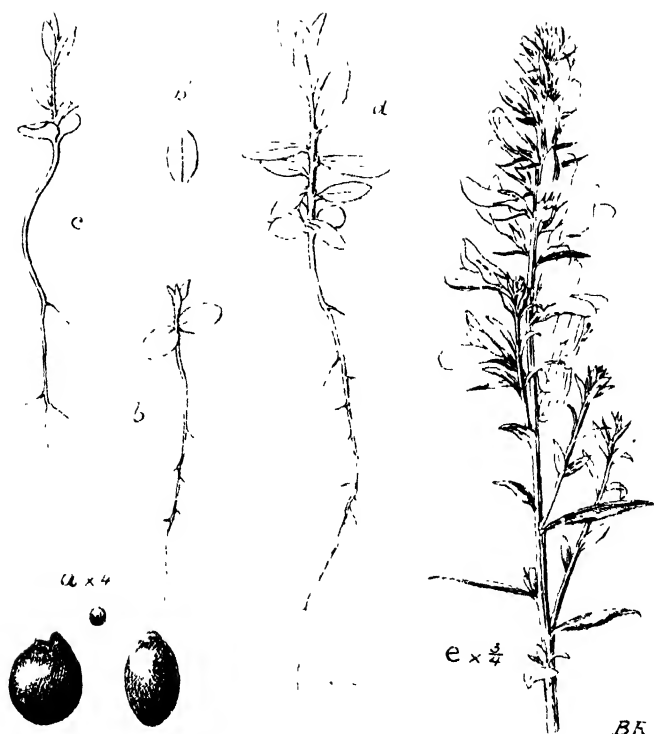


FIG. 1.—DYFR'S GREENWEED (*Genista tinctoria* L.).

a, Seeds, natural size and $\times 4$, *b*, early stage of seedling $\times 1$, *b'*, surface view of cotyledon, *c* and *d*, second and third stages of seedling $\times 1$, *e*, flowering portion $\times \frac{3}{4}$.

WEEDS OF GRASS LAND. IV.

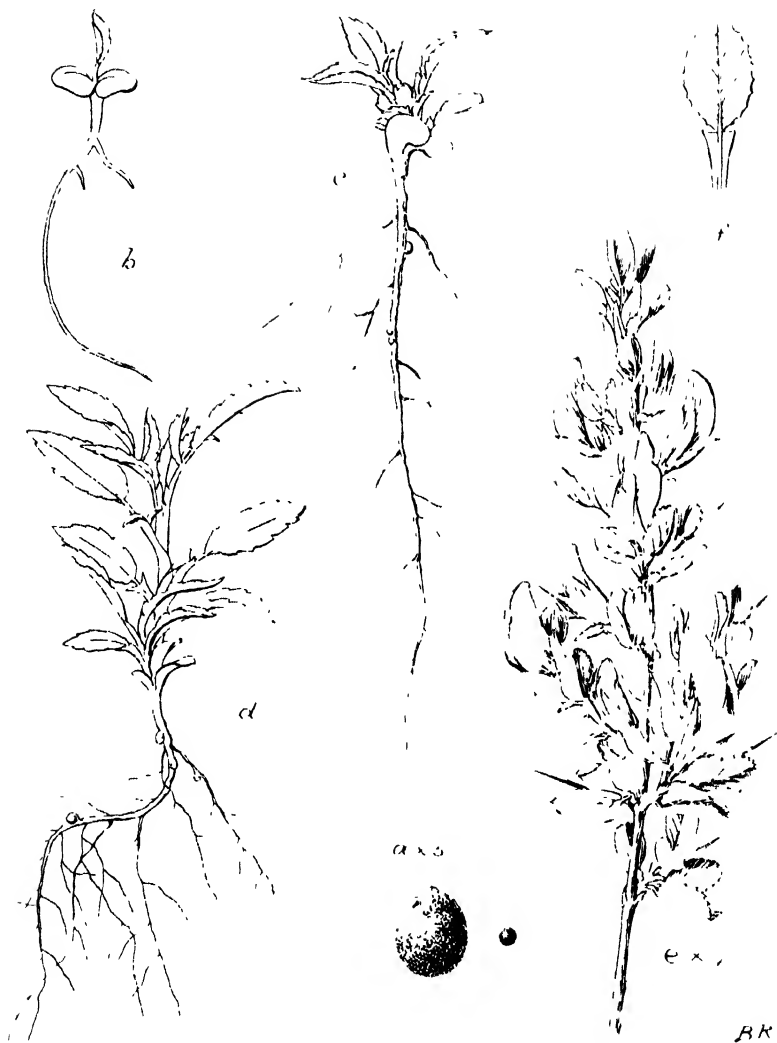


FIG. 2.—REST HARROW (*Ononis spinosa* L.)

a, Seeds, natural size and $\times 5$; *b*, *c* and *d*, first, second and third stages of seedling $\times 1$; *e*, flowering portion $\times \frac{3}{4}$; *f*, leaflet.



BR.

FIG. 3. COMMON BEAKED PARSLEY (*Anthriscus vulgaris* Pers.)

a., "Seeds," natural size and $\times 5$; *b.*, first stage of seedling $\times 1$; *b'*, surface view of cotyledon; *c* and *d.*, second and third stages of seedling $\times 1$; *e.*, flowering portion $\times \frac{1}{4}$; *e'*, flower enlarged.



BR.

FIG. 4. WILD CHERVIL (*Anthriscus sylvestris* Hoffm.).

a, Fruit, natural size and by 3; b, c and d, first, second and third stages of seedling; e, flowering portion $\times \frac{2}{3}$; f, flower enlarged.



FIG. 5. DANDELION (*Taraxacum officinale*, Willd.)
Showing a field with an immense quantity of seedling heads of
this weed.



FIG. 9. COMMON SEDGE (*Carex quadriflorus*, Gay)



2056-CRAT9

FIG. 6. COMMON RUSH (*Juncus effusus* L.).



FIG. 7. FIELD WOODRUSH (*Luzula campestris* Willd.).



FIG. 8. COMMON COTTON GRASS (*Eriophorum angustifolium* Roth.).

small grass-like plant (Fig. 7), which is common on dry meadows and pastures on almost all soils. (A tall sub-species of this plant, *L. multiflora* Lej., is common on wet pastures.) It is a perennial spread by means of both seeds and a creeping rootstock; it attains from 4 to 12 in. in height, and has flat, hairy, grass-like leaves—the long whitish hairs being very prominent—and dense clusters of small pale or dark star-like flowers.

Where these weeds are very plentiful, a general improvement in the herbage by liming, manuring, and grazing, and by drainage in the case of *L. multiflora*, is necessary to check them, as it commonly will.

Common Cotton Grass (*Eriophorum angustifolium* Roth.) and **Hare's-Tail Cotton Grass** (*E. vaginatum* L.) are perennial plants common in water meadows (as well as on moors and bogs), and are sometimes troublesome. The former species is about a foot high, and has solitary solid stems and terminal clusters of flowers, the inner clusters being sessile and the outer on slender stalks. The flowers appear in May and June. Hare's-tail cotton grass is somewhat similar, with many tufted stems and solitary terminal spikelets, which flower in April and May. In both species the floral envelope is formed of many long cottony hairs, the clusters when ripe appearing as a dense cottony tuft or head, 1 to 2 in. long and 1 in. in diameter (Fig. 8). The "cotton" is sometimes collected and used for stuffing pillows.

The cotton grasses will be reduced if the water-meadows in which they occur are generally improved by proper drainage, liming, manuring and grazing, with mechanical treatment if required, as suggested against rushes.

Sedges.—In general, sedges somewhat resemble grasses, both in the leaves and spikelets. A large number of species are known; they vary widely in their habit, some favouring dry soils and others wet ones. Common Sedge (*Carex goodenowii* Gay.) and other species of *Carex* are common, useless plants of damp meadows and pastures, water meadows, and by the sides of ditches and rivers. The common sedge (Fig. 9) is a perennial, with narrow erect leaves, and a rough, slender, stiff stem 1 to 2 ft. high. The spikelets are sessile, from $\frac{1}{2}$ to 1 in. in length, and placed three to five together on the axis or stem. The rootstock often creeps extensively.

Sedges that occur on wet soils may be reduced by the measures recommended against rushes.

Sedges of other species (e.g., *Carex praecox* Jacq.) occur on

poor, dry pastures, and on moors, and may have a tufted or creeping rootstock. They more or less resemble the foregoing species. Several kinds with bluish-green leaves, resembling those of the carnation, are termed "Carnation-grasses" by farmers. On dry pastures, sedges should be cut regularly, and the herbage should be improved by mechanical treatment, liming, appropriate manuring and grazing.

THOMAS HITT: AN EIGHTEENTH-CENTURY HEATHLAND FARMER

G. E. FUSSELL,

Ministry of Agriculture and Fisheries.

THE lives of men whose writings, in the pre-scientific days of agriculture, have contributed to the development of farming practice are often obscure. What we know of them is usually limited to the theories and practices advanced in their books, in which, however, the authors sometimes intrude casual remarks about themselves that serve to throw a little light upon their lives. Probably these were no more exciting, although just as satisfying, as are, and always have been, the lives of practical men in any field of human endeavour.

The life of Thomas Hitt, the subject of this note, is no better documented than that of many other agriculturists of his period. He wrote two books—*A Treatise of Husbandry: on the Improvement of Dry and Barren Lands*; and *A Treatise of Fruit Trees*. The latter was published in 1755; the former appeared in 1760.

It has been stated that the author died about the year 1710, and that the books were published from manuscripts found after his death,* but this is very doubtful because of statements he himself makes in the books. Donaldson tells us that Hitt was gardener to Lord Manners, at Bloxholme in Lincolnshire, but this information is taken from the title-page of *A Treatise of Fruit Trees*. He adds that the author was a native of Aberdeenshire, and, after much serving as a gardener, became a nurseryman and designer of gardens in Kent.

Hitt, himself, says (in his *Husbandry*) that he served his apprenticeship at Belvoir Castle, a possession of His Grace the Duke of Rutland, and that he planted a warren on the estate with oak in the year 1724. At a later stage of the work,

* John Donaldson: *Agricultural Biography*, 1854, p. 54. Mary S. Aslin: *Catalogue of Printed Books on Agriculture, Rothamsted Experimental Station*, 1926.

he supplies observations on the seasons he had experienced. "The following are observations I have made," he says, "on the prices of corn and likewise of the seasons, as to their being excessive wet or dry." The series opens with 1727, when the summer was very wet, as it was also in 1728; consequently, prices rose, wheat from 4s. to 8s. per bushel and barley from 2s. 3d. to 4s. In 1729, the spring and summer were dry and corn was cheaper; in 1746, spring and summer were very dry and barley fell to 1s. 4d.; 1757 was a wet year. It is possible that these remarks may have been inserted by an editor, but, on the other hand, there is every reason to suppose that Hitt wrote them himself, so that the year of his death must have been much later than 1710. The preface to this book, indeed, is dated 1760, "Chislehurst, at the Right Honourable Lord Robert Bertie's," and confirms that Hitt spent part of his time in Kent. The imprint, moreover, states that it was printed "for the author."

The major portion of Hitt's life, however, as he tells us in the preface to the *Treatise on Fruit Trees*, was spent in Lincoln and Nottingham, where "the great part of my time I have had the honour to be a servant to some of that noble family (the Duke of Rutland's) who are all so willing to encourage a person who desires to improve his knowledge . . . my practice has chiefly been within twenty miles of Newark-upon-Trent . . ." He resided most commonly in Lincolnshire and Nottinghamshire after leaving Robert Sutton of Kelham.

The *Treatise of Fruit Trees*, of which the second edition appeared in 1757, was, Hitt claims, occasioned and promoted by several gentlemen who liked to spend some time in their gardens. It contains a catalogue of fruit, directions for draining, burning of clay, manuring, all the arts of pruning, describes walls and wall fruit, and instructs the nurseryman how to pack trees for transport. It also gives a list of instruments required by a dresser of fruit trees.

Hitt's places of domicile, in Lincoln, Nottingham and Kent, show us why his *Treatise of Husbandry* has the subsidiary title of "the improvement of dry and barren lands." His situation was such that the reclamation of heath and the improvement of sandy soils was, necessarily, his immediate pre-occupation. In spite of this, he feels it incumbent upon him to apologise for adding to the already long list of farming books. "After so many large and learned Treatises upon the subject of Agriculture," he says in the preface, "I imagine this will be thought superfluous; but as I write with an intent of being of

service and assistance to my country, that determined me to publish this Treatise . . .”

“What chiefly induced me to this Undertaking was a visible want of Men to defend His Majesty’s Dominions, and the Poor complaining of the Scarcity of Bread.” In all the country with which he was acquainted, there were large tracts of waste and warrens that might be reclaimed and cultivated, and the poor need not be denied the privilege of collecting furze for fuel on these wastes, because one acre of enclosed waste would produce as much brushwood as ten where animals graze. So far as his precepts were concerned, they were such as he had caused to be practised with good success ; and he hoped many others would reap benefit from them.

The local backwardness of farming did not please Hitt. He had been told that land was left untilld for want of manure, even in places where lime could easily be obtained. The farmers thought dung the only possible manure ; Hitt sings the praises of lime, soot, pigeons’ dung and marl, and says that burning is good in many sorts of poor land. It adds salts by the burning of the grass roots, and opens clay. “Agriculture has always been a most useful employment for man,” he says. “It is well known the Almighty sent Adam to till the land, and at this time it is a work still necessary for the support of human life. It is not, however, carried on in all places to such advantage as it might be . . .”

In open fields, the cultivation of which by the newest methods was often a matter of some difficulty, “the first improvement is to be made by enclosure (where it is possible to be done), then it will be in the power of the possessor to order it according to his pleasure . . .” The best meadows and pasture lands were, in his opinion, the class of land least capable of improvement, and if they would fatten a large ox in three or four months should always be continued in their existing state. The average pasture was, however, very capable of improvement, especially rough grazing. Trees should be planted on the mountains, and rabbits should be confined by stone walls. He admits that he has never carried out the reclamation of a warren, but has dealt with land of the same nature close to a warren, and estimates 10 per cent. as the profit derived from the work.

The system of reclamation he adopted was fairly widely known in his day, and was practised extensively during the expansion of the tillage area consequent upon the growth of population in the last quarter of the eighteenth century, and

upon the shortage of supplies caused by the bad harvests and the Napoleonic Wars.

Practical as was the advice contained in Hitt's *Treatise*, it must reluctantly be admitted, therefore, that his system was not original, although he may have been one of the first few men to try it out empirically. It had, indeed, been known for at least a hundred years. Gabriel Reeve, in *Directions left by a Gentleman to his Sons for the Improvement of Heathy and Barren Land*, 1670, says: "you shall see how an industrious man in Brabant and Flanders would bring five hundred acres of barren and heathy land, that was not worth at the most above fifty pound a year, to be worth seven thousand pound a year" (he was evidently more optimistic than Hitt) "in less than seven years. I know no reason why the like may not be done in England." He thinks the system would work on land like Sandy (? near Kingston-on-Thames) or St. Leonard's Forest, especially as "we have the advantage of marl and lime, which the Boores" [Dutch or Flemish peasants] "have not." His process was to break up the land with a strong team, cross plough, tear out the heath with a "great harrow," gather and burn it, dung with about 20 loads an acre, sow rye, then oats with clover, bush-harrowed in. An acre of clover, part mown and part fed green, would, he estimated, keep four kine summer and winter.

Reeve also describes experiments in paring and burning, followed by a dressing of lime, with turnips as a first crop. This book also is derivative, being almost a verbatim copy of Sir Richard Weston's *Discours of Husbandrie used in Brabant and Flanders*, second edition, 1652, and the system advocated by Hitt is also, to all intents and purposes, laid down in Gervase Markham's *Inrichment of the Weald of Kent*, 1625. It is probable that much the same thing is contained in *The Gentleman Farmer*; or, *Certain Observations made by an English Gentleman upon the Husbandry of Flanders, the same compared with that of England*, 1726, which is attributed to the Hon. Roger North, but which the writer has not yet seen, although it is mentioned in McDonald's bibliography and in a second-hand-book seller's catalogue.

Hitt's system was first to pare and burn. For the purpose, a breast plough or a paring plough was used; the latter was known as the Rockoliff plough in the Fens of Cambridge and Lincoln. It had a circular coulter, which moved on an axis fixed to the beam, and it was drawn by two horses. It was most expeditious on carr or moss land, but of no use on land having

many stones, etc. The other instrument was called by various names in different parts of England. In the north it was known as a floating or paring spade, in some places as a breast plough, and in others as a denshiring shovel. It was a broad spade with one edge turned up to form a sort of mouldboard and to cut off the turf, and the method of using was to push it forward from the thighs. It had a shaft some $7\frac{1}{2}$ ft. long, with a fairly long cross handle which rested on the thighs, the latter being protected by wooden or leather harness. With this implement a good hand could pare about an acre in four days. The turves so cut off were stacked till dry and then burnt, the resulting ashes being scattered over the land to serve as manure. Hitt preferred this implement to the horse plough. On lands covered with ling, furze and old grass, sufficient improvements may be made by burning and proper tilling; and if they are pared with a breast plough, "it will have an excellent effect for then there will be more earth than if the land was broke up with a horse plough . . ."

"The land that cannot be pared with a breast plough, is such as is mixed with pebble, or other stones near the surface; for either of them injures the instrument, which ought to be kept extremely sharp." After this treatment, turnips or cole were sown and eaten off by sheep, then barley or oats the following spring, then wheat or rye, and, after that, grass seeds. If allowed to fall down, as it so often was, there was no improvement in the pasture. Hitt advocated 10 lb. trefoil and 1 lb. rye grass an acre, sown under the grain, as a good seeds mixture. Land treated in this way would produce plentiful crops of corn for three or four years, if required, and be in rich order thereafter for any sort of grass seeds. If the land had been burnt before the middle of May, barley might be sown at once; and if not a loose, deep sand, 4 lb. cinquefoil with the barley. On a farm worked on this system, there should be as many sheep as the land will keep because of the value of their manure by folding.

Wheat, if not sown with one of the drills, which were then really only in the experimental stage, should be sown at ten pecks an acre and ploughed in; the seed should be brined to prevent bunt, and compost was better than farmyard manure alone. On a new farm, the manure should be put on clover any time during the winter. Parsley, it is suggested, might be sown under wheat; it would make wholesome feed for the sheep for a whole year. Winter tares were good as a spring feed for sheep, milch cows or horses, when long enough to be mown.

Rye was, however, better on poor, dry lands. It was very useful grain for fattening hogs, or "to mix with wheat to make bread of; it renders it sweeter and less dry in the summer than wheat alone, and more esteemed by many."

Bush harrowing is recommended for young grass. A large thorn bush should be dragged by a horse all over the ground on a dry day; or, for want of a large bush, small ones may be used by fixing them in a harrow, gate, fleak or hurdle. This process was used for tearing out moss, and after winter-claying of the pasture. When old clover or other "artificial" grass had been pastured for five or six years, it might be ploughed for oats, followed by wheat or rye, and again laid down.

Such a system of farming on reclaimed warrens would, Hitt thinks, be very advantageous. He estimates that there were 100,000 acres of suitable land in one county alone, and suggests that 10,000 acres should be planted, the remainder being cut up into 500-acre farms. The results will be a large increase in population as well as profit to the landlord. In place of the 500 people required to look after the warrens, there will be an addition of 3,280 people, and to these again will be added the tradesmen necessary to supply their wants. Hitt has great reason to suppose that the corn raised upon these dry, sandy lands would be of extraordinary service, and that each farm of 500 acres would produce 100 quarters net.

There will, moreover, be an undoubted benefit to the landlord who sets about such work. An estimate for enclosing 500 acres of warren is supplied, and the cost of a house of four rooms on a floor, with a barn, stable, dove-house and other convenient outbuildings, also with a garden and orchard, fit for a farming tenant, at the highest rates, will be £300. This will allow the rent to be raised from 1*s.* to 5*s.* per acre, and, including an allowance for capital expenditure, the profit will be £55 10*s.* per annum, or three times as much as before. From the sportman's point of view, also, there will be an advantage, because the warreners destroy foxes and hares, and the rabbit burrows are dangerous to hunters.

On each of these farms, a flock of 500 ewes and their offspring should be kept whereas only a few sheep are kept on the warrens in the summer. The wethers should be sold at two or three shear with culled ewes, *i.e.*, at about 60 a year; and a clip of 250 each year, or about five packs of wool, if the fleece is between four and five pounds, an obvious benefit to the country at large.

Another reason for doing this work was the shortage of rural housing. Many people were prevented from marrying by the want of habitations, both farmers' sons and men and maid servants. These unfortunates were forced to go to London, or other great cities, where few children were born. Moreover, milk was difficult to come by in the country, especially for the labourer unless he kept a cow; and the unstinted common pastures were overstocked by the rich commoners to his disadvantage and, indeed, to their own, although they conserved their supplies of winter feed by this means. Hitt thinks, therefore, that the heavy clay commons should be tilled, and old tillage ploughed up for grass. Many of the old enclosures might easily be improved.

The implements recommended for use on the farms reclaimed from the warrens were ploughs "such as can be used in sand land with only two horses abreast, and guided by reins, by the men that holds the plough." Both heavy and light harrows are necessary; and a roller will be extremely useful. The latter should be made of oak, 2ft. diameter and 5ft. long, and fitted with shafts like a cart. Elaborate details for the treatment of each field are supplied, and Hitt sets out the best size to make them for the purpose of following his ideal rotation.

BIBLIOGRAPHY

(1) *A Treatise of Fruit Trees*. By Thomas Hitt, Gardener to the Right Honourable Robert Manners at Bloxholme, in Lincolnshire. Second Edition. (First Edition 1755, according to Roy. Agric. Soc. Eng. Catalogue.) 8vo illus., pp. viii+392. London, 1757.

(2) *A Treatise of Husbandry, on the Improvement of Dry and Barren Lands*. 8vo, pp. xiv+208. London, 1760.

MARKETING NOTES

The National Mark : Address to the Birmingham Rotary Club.—*The following is a synopsis of an address which was given to the members of the Birmingham Rotary Club on January 26, 1931, by Sir Charles Howell Thomas, K.C.B., C.M.G., Permanent Secretary of the Ministry of Agriculture and Fisheries.*

In his introductory remarks, Sir Charles pointed out that in commerce the production of uniform and standardized commodities had been achieved through the evolution of businesses into large units. In agriculture, however, individualism had continued, comparatively little success having been attained by efforts to secure combination by co-operative enterprises. On the other hand, modern tendencies in other industries had been followed by oversea agriculturists in order to exploit the valuable market which existed in this country for their products. They had developed a system of marketing in which the dominant feature has been the presentation of their wares in uniform sizes and qualities and in standard packages so that bulk supplies can be easily handled. The result was that, in many cases, the wholesale markets had preferred imported supplies to home produce, which lacked uniformity in quality, methods of packing and regularity of supply.

To assist home producers to compete more equally with those abroad, and to reap the natural advantages of proximity to their markets, it had been the policy of successive Governments in recent years to encourage the reorganization of the marketing arrangements of our farmers, and it was in pursuance of this policy that the late Government passed the Agricultural Produce (Grading and Marking) Act of 1928, which gave birth to the National Mark Scheme.

The essentials of this scheme were the definition of official standards of quality (by regulations made under the Act of 1928), the encouragement of grading to those standards, as well as, where practicable, of packing in standard packages, and the sale of such standardized produce under one trade-mark—the National Mark.

The scheme was at present entirely voluntary, but authority to use the Mark was only granted to those who accept certain conditions designed to secure the efficient grading and packing of the products, so that the Mark might be associated in the public mind with only best quality home produce.

The policy of the scheme was advocated by all political parties, and not only was it sound statesmanship but it was

also good business. It had been developed and was being applied, commodity by commodity, after full investigations and discussion with the various interests concerned. With the exception of beef, the grading and application of the National Mark were carried out by the producers themselves, either as individuals or in association, or by other organizations and agencies specially authorized by the Ministry. In order to ensure that the standards of quality for the commodity were maintained at a reasonable level, authorization to grade and pack under the National Mark was only granted to those who had the skill, equipment and turnover to permit them to carry out the tasks involved efficiently and economically. Their work was subject to inspection by officers of the Ministry, and the system of labelling was such that the produce could always be traced back to the packing station without difficulty.

Apples and pears were the first home products to which the National Mark was applied—in the autumn of 1928. This scheme was now well established and the demand for high-class National Mark apples and pears far exceeded supplies.

Last year, experimental schemes were introduced for strawberries and cherries, with very satisfactory results. National Mark strawberries met with a very keen demand and their appearance on the markets, by example and contrast, stimulated the trade as a whole towards ending the "topping" and short-weight evils.

Tomatoes and cucumbers were other fruits to which the scheme had been applied with success, and there had been a definite improvement in the grading of both these products, not only by National Mark packers, but also by growers who, as yet, did not use the Mark.

A good start having been made with fresh fruits, the National Mark Scheme was extended last season to certain varieties of canned fruits, peas and beans. Many millions of cans bearing the National Mark had been packed during the past season and some of the leading packers had announced their intention of extending their operations considerably next summer. This was proving one of the most popular groups of commodities to which the scheme had been applied, retailers reporting that consumers had quickly appreciated the opportunity of obtaining their favourite English fruits in winter. The outlook for this scheme was, therefore, most promising.

The National Mark scheme for eggs, which was introduced in the early part of 1929, had given to egg producers a weapon

with which to combat the competition of imported eggs. As a result of the scheme, graded English eggs had not only gained entry into the wholesale markets where they were hitherto almost unknown, but they had gained the premier position in those markets. Over 200 million home-produced eggs were handled by National Mark packers last year. Egg production in this country was increasing rapidly, and the scheme was providing producers with up-to-date machinery for the marketing of their output.

A start had been made on an experimental scale with the packing and sale of dressed poultry under the Mark.

Under the National Mark, all-English wheat flour of standard quality had, for the first time, been placed on the market. The flour scheme had now been in operation for two seasons, and there were some 180 authorized millers and packers. The demand for this flour varied in different parts of the country, but as a result of the Ministry's publicity, of propaganda work undertaken by the National Farmers' Union among its county branches and by the Women's Institutes, who were arranging cookery competitions, its sale was extending steadily in country districts. A number of bakers now baked a loaf from all-English National Mark flour, and had reported a considerable increase in sales as a result of their enterprise.

Livestock raising was perhaps the most important branch of agriculture, and, with the continued depression in cereal prices all over the world, it was one to which our farmers were likely to devote more and more attention. The livestock industry had, however, to face severe competition from imported supplies, and particularly from chilled beef from South America. Considerable importance was, therefore, to be attached to the scheme for the grading and marking of home-killed beef under the National Mark which was introduced in London and Birmingham on a more or less experimental basis towards the end of 1929. The results had been so satisfactory—particularly in London—that, following the recommendation of a Departmental Committee which investigated the scheme last year, it had been decided to extend it to the Leeds, Bradford and Halifax areas.

It was very difficult for the average housewife to classify beef in the shop, and it was one of the advantages of the National Mark Scheme that the grade marks of the three grades were applied in such a manner that the mark was readily distinguishable on all the principal joints. Only beef

of good quality was graded under the scheme, and, in purchasing National Mark beef, the public could be certain that they were obtaining the best quality home-killed meat, while the distributor received, through the Mark, a hall-mark for his goods and retained the confidence of his customers.

Malt products, including malt extract with cod liver oil, were also available under the National Mark. A scheme for applying the Mark to cider had been introduced recently. National Mark cider would be placed on retail sale next May.

On the question of publicity for National Mark products, Sir Charles explained that, in introducing the National Mark Scheme, the Ministry recognized that it was not sufficient to provide a means for the standardization of home products; they must also be advertised and their benefits proclaimed.

The Ministry itself had carried out a strong programme of publicity during the past year, special attention being paid to the National Mark beef scheme in view of its rather exceptional nature. Every possible medium of advertisement had been used, including the national and local Press, posters on hoardings, in trams and on van sides, streamers on 'buses in London, slides in cinema theatres, displays of National Mark products at trade and other exhibitions, together with a new type of publicity in the form of National Mark Shopping Weeks, which had been held in a number of important towns.

It was very gratifying to find that packers themselves were also taking up the advertising of their products.

Dealing with the National Mark Scheme in its local application to Birmingham, Sir Charles said that, in common with other big centres of population, Birmingham was a city to which considerable quantities of National Mark goods found their way. Large supplies of National Mark fruit, particularly apples and strawberries, appeared in the Birmingham markets during the past season. Birmingham was selected as one of the two centres for trying out the National Mark scheme for beef. Unfortunately, progress had not been so satisfactory as in London, but with the aid of the extensive publicity campaign which the Ministry had been carrying out for the past nine months, the number of sides of beef graded and marked under the scheme had been on the increase, reaching a record total in the week before Christmas.

The value of the scheme to producers lay in the fact that it gave them, for the first time, an opportunity of selling their products on standardized lines. The increased public demand for these products encouraged farmers to produce high quality

commodities, and offered them the stimulus of steadier and, frequently, better prices.

Distributors had the advantage of dealing in standardized produce of uniform quality in bulk supplies. They could order on grade and sell with confidence. All this led to economical handling. The Ministry's supporting publicity assisted them to push sales with the certainty that the consistent quality of the commodities would give confidence to their customers. The Mark gave Government backing to distributors. They were accustomed to deal in branded goods, but in the past there had been no brand for much of our home agricultural produce. There was now available a definite brand—the Nation's brand—which distributors could push and advertise, as many of them were doing.

Consumers had, for the first time, an impartial guarantee of quality; they knew what they are buying. They could form the habit of buying by the Mark just as they were accustomed to buy by the brand in the case of certain household commodities.

In conclusion, Sir Charles said :—

“We all have an innate desire to help our Motherland. The National Mark Scheme gives us an opportunity to do so, without detriment to ourselves and in the knowledge that we are both deriving personal advantage by buying the best foodstuffs available, and ensuring employment for British workers, while helping those of our kith and kin who live by the products of our soil.

“I appeal to all present to become propagandists for the National Mark, the development of which will, I am convinced, mean much to all who are interested in our markets, either as home producers, distributors, or consumers.

“The national advantages resulting from the goodwill attaching to the National Mark are obvious, and I am sure that those advantages will be readily appreciated by, and commend themselves to, the business community generally.”

National Mark Eggs : A Review of Progress.—The second year's working of the National Mark Egg Scheme was completed on January 31, 1931, and the occasion calls for some account of the progress of the scheme during that period. Two slight modifications of the original scheme were made during 1930. A regulation was introduced requiring the code-marking of all packages of National Mark eggs (except 1-doz. and $\frac{1}{2}$ -doz. cartons) with the date of packing, and the statutory

grades were increased to four by the addition of a lower weight grade. The other grade designations were altered simultaneously. The four grades for hen eggs are now :—Special or Special Weight, Standard or Standard Weight, Medium or Medium Weight, and Pullet or Pullet Weight.

In general, it may be said that during the first year of the scheme its effects have been extended and its influence increased. Apart from the fact that still larger quantities of home-produced eggs were graded and packed to National Mark standards, the scheme has now definitely established the National Mark egg as pre-eminent in the wholesale markets and has still further raised the level of efficiency in marketing technique.

The public is not yet fully educated as to the superior worth of graded eggs, and the difference in price of graded, as compared with ungraded, eggs is, in consequence, not so great as is warranted by their extra value. Partly owing to this, a number of authorized packers have withdrawn from the scheme, the number operating on January 31 of this year being 140, as compared with 150 a year previously. Nevertheless, the turnover of eggs packed under the Mark in 1930 was considerably higher than in corresponding months in 1929. Approximately 160 million eggs were packed under the Mark in 1930, representing over 70 per cent. of the total turnover of eggs sold by the packing stations. While the National Mark output represents only about one-twelfth of the production of eggs on farms in England and Wales, it obviously forms a much higher proportion of that part of the supply that passes through commercial channels. The scheme is bound to become more important each year in view of the increase of the home-produced egg supplies for which markets have to be found in the large centres of consumption where the demand is for standardized qualities, grades and packages.

An important development took place in February, 1930, when the authorized packers formed an organization known as National Mark Egg Central, Ltd., to act as a central co-operative selling agency, in order to widen the channels of distribution of National Mark eggs, and to secure the economies of large-scale, centralized distribution, with a closer adjustment of supply to demand throughout the country. The company has worked, through its accredited agents, in a number of large consuming centres, including London (where its agents have been members of the London Egg Exchange), Manchester, Liverpool and Birmingham. During

the period March, 1930, to January, 1931, the number of National Mark eggs handled by the Society's agents reached a figure of nearly 20 millions. These eggs were mainly supplies for which packers needed a new market, and the service that National Mark Egg Central, Ltd., has rendered to the home egg industry as a whole, in clearing this surplus through its agents without a severe break in prices, has been of the highest value.

In keeping with the downward trend in commodity prices during the year, egg prices have also fallen, but National Mark eggs have emerged in a relatively stronger position. The price margin, between National Mark eggs and the best imported eggs, that was secured in 1929, has been well maintained in 1930. The margin in favour of National Mark "Specials"—which roughly correspond in weight to the Danish 18-lb. egg—was noticeably higher in the flush season of 1930 than in that of 1929. An appreciable margin is observed when comparing the prices of National Mark "Standards" and Danish 15½-16-lb. eggs; in fact, taking monthly averages of National Mark Egg Central's prices for "Standards" and the Smithfield Market prices for Danish eggs, margins exceeding 5s. per 120 in favour of National Mark "Standards" were secured for a considerable period during last year. It is also noteworthy that the wholesale prices of National Mark "Standards" on the London market in 1930 showed a margin of up to 3s. per 120 over that of "first quality" ungraded English supplies. Incidentally, National Mark eggs are the only home-produced eggs the prices of which can be quoted throughout the country on recognized grades, and they are the only home-produced eggs quoted on the London Egg Exchange. They are also the only home-produced eggs that can be advertised nationally.

The indications are that the distributive trade and the public are becoming increasingly alive to the value of National Mark eggs, while, at the same time, the scheme is rendering valuable service to the producer. This is seen, for example, in the annual report of the Stonegate and East Sussex Farmers' Co-operative Society, Ltd., which has made an average price over the year for "Standards" of just over 2s. 1d. per dozen.

A striking feature of the year's operations has been the increase in output of some of the largest stations. Complete figures are not available for 1929, but the following statement shows the throughput of five of the largest packing

stations during 1930. Four of these stations are producer-controlled.

	<i>Total Output millions</i>	<i>Output under National Mark millions</i>
(1) Norfolk Egg Producers, Ltd., Norwich	8.4	8.0
(2) Wiltshire Egg Producers, Ltd., Hungerford	7.6	7.4
(3) Gloucestershire Co-operative Marketing Society, Ltd., Cheltenham	5.8	5.2
(4) Messrs. Williamson's, Ltd., London	5.5	4.8
(5) Melton Mowbray District Far- mers' Association, Ltd., Melton Mowbray	4.5	3.9

An advance has been made in the output of National Mark eggs from the recognized "exporting" areas such as Cornwall, whence large supplies from a number of smaller stations are regularly consigned to London. Development is not, however, confined to "exporting" areas. A London example is given above, while the Sussex station previously referred to, which markets at short-range chiefly in the Metropolitan area, has also been able to record the doubling of its output as compared with the previous year. There are still a number of areas where no National Mark packing stations exist, and it is hoped that, in these areas, producers will take up the running and establish their own co-operative stations as soon as possible.

Mention should also be made of the attitude of the distributive trade. Apart from the activities of National Mark Egg Central, Ltd., and its agents, a number of wholesale firms deal regularly in increasing supplies of National Mark eggs; while, at the retail end, definite progress is being made. A typical instance is seen in the record of the Bradford Co-operative Society which, in 1930, disposed of 1 million National Mark eggs, no other English eggs being handled. Two or three years ago, the Society dealt almost solely in imported eggs — now National Mark eggs account for over 50 per cent. of their turnover! Again, in Birmingham the largest co-operative society in the City purchased, in 1930, nearly 2½ million National Mark eggs, and is reported to be intending to purchase much larger quantities in 1931.

A number of retailers are also developing their trade in one-dozen and half-dozen cartons. It is hoped to see a further increase in this trade, whereby the guarantee of the Mark on the package is carried right through to the consumer.

National Mark Poultry.—The Ministry has just issued a new leaflet (Marketing Leaflet No. 26) describing the Shenley Poultry Products, Ltd., National Mark Poultry Demonstration Station at Shenley Farm, Headcorn, Kent. This organization is a Co-operative Society, which was registered under the Industrial and Provident Acts in June last. The qualifications for membership include guarantees that a member's whole output of table poultry will be delivered alive to the Society after attaining a specified weight, and that the member will raise chickens for ten months in the year. The Society provides for the fattening, killing, plucking, shaping and cooling of the birds, which are subsequently graded according to weight and quality and marked by the attachment of the appropriate National Mark disc. They are then packed in single layers in non-returnable crates for dispatch to the markets. Many of these processes are illustrated in the leaflet.

In return for a grant from the Ministry, it has been arranged that the Society shall conduct interested persons round the station and explain to them the method of operation. Other producers may, therefore, have an opportunity to profit by the experience of this Society. Intending visitors are recommended to make an appointment in advance.

Copies of the leaflet may be obtained, free of charge, on application to the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.

National Mark Beef.—The weekly average number of sides (including quarters and pieces expressed in terms of sides) of beef graded and marked with the National Mark during January, 1930, and January, 1931, respectively, and the number of sides graded and marked for the four weeks ended February 14, 1931, were as follows :—

LONDON				<i>Number of Sides</i>
<i>Weekly average</i>	..	January, 1930	..	1,193
	..	" 1931	..	1,944
<i>Week ended</i>	..	January 24, 1931	..	2,149
" "	..	" 31, 1931	..	1,797
" "	..	February 7, 1931	..	1,729
" "	..	" 14, 1931	..	2,133
BIRKENHEAD*				
<i>Weekly average</i>	..	January, 1930	..	191
	..	" 1931	..	718
<i>Week ended</i>	..	January 24, 1931	..	685
" "	..	" 31, 1931	..	718
" "	..	February 7, 1931	..	515
" "	..	" 14, 1931	..	311

* Sides consigned to London.

SCOTLAND*				Number of Sides
Weekly average	..	January, 1930	..	1,353
" "	..	" 1931	..	2,285
Week ended	..	January 24, 1931	..	2,276
" "	..	" 31, 1931	..	2,186
" "	..	February 7, 1931	..	2,213
" "	..	" 14, 1931	..	2,446
TOTAL LONDON SUPPLIES (All Sources)				
Weekly average	..	January, 1930	..	2,737
" "	..	" 1931	..	4,947
Week ended	..	January 24, 1931	..	5,110
" "	..	" 31, 1931	..	4,701
" "	..	February 7, 1931	..	4,457
" "	..	" 14, 1931	..	4,890
BIRMINGHAM				
Weekly average	..	January, 1930	..	437
" "	..	" 1931	..	467
Week ended	..	January 24, 1931	..	463
" "	..	" 31, 1931	..	481
" "	..	February 7, 1931	..	513
" "	..	" 14, 1931	..	469
LEEDS				
Week ended	..	January 31, 1931	..	637
" "	..	February 7, 1931	..	663
" "	..	" 14, 1931	..	730
BRADFORD				
Week ended	..	January 31, 1931	..	294
" "	..	February 7, 1931	..	380
" "	..	" 14, 1931	..	416
HALIFAX				
Week ended	..	January 31, 1931	..	82
" "	..	February 7, 1931	..	94
" "	..	" 14, 1931	..	130

* Sides consigned to London.

There was a slight decrease in the quantity of National Mark beef on the London market during January, mainly owing to a general drop in prices in the middle of the month. The trade in chilled beef led the decline, and wholesalers in home-killed beef were shy of throwing supplies on a falling market. During the month, 21,908 sides of home-killed and Scotch-killed beef were graded and marked under the scheme.

From February onwards, better cattle from the straw-feeding areas come forward, and English beef at this period of the year is of exceptional merit.

The system of sale of gradable cattle from farm to abattoir on a grade and dead-weight basis has made further progress. Many more inquiries have been received from farmers, and there is now a regular supply of cattle reaching the market

from sales on this system. The insurance scheme against disease is in operation, and all wholesalers who are buying cattle under the system have taken out policies.

The National Mark beef scheme was inaugurated at Leeds and Bradford on January 26, and at Halifax on January 27. A most satisfactory start was made at each centre. During the first week, 1,013 sides of beef were graded and marked. The quality of the beef offered for grading at these centres was unusually high.

Report on the National Mark Scheme for Apples and Pears.—The apple and pear scheme has now completed its third season and may be considered to be firmly established. Most of the authorized growers realize that the advantages accruing from its operations are not necessarily to be found in any immediate or definite increase of returns to the grower, but rather in the general success and progressive improvement in marketing which is proving of benefit to the industry as a whole.

Judging from observations made at the Imperial Fruit Show at Leicester last October by authorized packers and by growers who applied there for authorization, there is no doubt that the scheme is not only firmly established but is moving forward by its own momentum. Its progress has certainly exceeded anticipations.

By drawing attention to the active demand for high-grade home-grown apples and pears, the scheme has induced growers to make more strenuous efforts to improve the quality of their crops. This has been welcomed by those County Authorities who are concerned with fruit production because of the support which it affords to their own efforts and the acceleration of the progress of their work which has resulted.

Authorized Packers.—During the first two seasons, 70 growers were authorized to apply the National Mark to apples and 9 to pears. During 1930, a further 27 have been authorized for apples and 9 for pears, making the present total of authorized packers 97 and 18 respectively. Last season's heavy crop of good quality pears may have been to some extent responsible for the relatively large increase in the number of pear packers.

Quantity Marketed and Standard of Production.—No definite information is available of the quantity of apples and pears marketed under the Mark, but information obtained from both growers and distributors makes it obvious that the total number of packages of National Mark apples has

steadily increased from season to season. During 1930, the position has been affected by the abnormal export of home-grown apples to Germany, Holland and Belgium.

At the beginning of the scheme, the growers packing under the Mark were mainly those who had previously graded and packed approximately to National Mark standards. Other growers, however, applied for authorization in respect of apples without a full realization of the meaning of the quality standards required by the scheme, and consequently found that the proportion of their total produce that reached National Mark grade was very small. The National Mark Scheme has undoubtedly been an object lesson to many growers of low quality fruit, and, largely as a result of National Mark propaganda, apple growers in all districts have been exerting every effort during the last two years to secure better quality supplies. The result of these efforts is now becoming visible, and it is probable that, although the apple crop in 1930 was only fairly good as regards total weight, the quantity of good grade apples marketed has been greater than in any previous season. This improvement in the standard of production, however, cannot yet be fully demonstrated in terms of National Mark packages. Large-scale growers who are now producing high quality fruit, and who are changing over to packing in accordance with the National Mark regulations, find that the organization of grading and packing staffs is a matter of great difficulty. Hence, it will be two or three years before the whole of the output of such growers can be marketed under the National Mark.

Distribution of Supplies.—In the first year of the scheme, the distribution of National Mark apples and pears was almost wholly confined to the London and Manchester markets. The publicity which has been undertaken and the advertising power of National Mark apples themselves have created a live interest in the scheme in practically all provincial markets, with the result that, in the second season, limited supplies reached all the principal midland and northern provincial markets. During the 1930 season, several authorized packers made determined and successful efforts to decentralize distribution, and their consignments of National Mark supplies to the smaller markets stimulated local interests and met with a keen demand.

Inspection of National Mark Supplies.—Visits to packers and markets in connexion with the scheme have been regularly undertaken by the Ministry's staff, and it may be said that the

standard of quality of National Mark apples and pears has been well maintained during the season. It is noteworthy that a general improvement is taking place in grading and packing, owing to increased experience of packing operatives and closer supervision of their staffs by authorized packers.

Amendments to Scheme.—As a result of experience gained in the working of the scheme, certain minor amendments were effected before the 1930 season. The most important amendment was the abolition of "C" grade dessert apples, which may not now be packed under National Mark labels.

Packages.—The schedule of approved packages drawn up at the outset of the scheme appears to have met requirements, and very slight variations have been necessary. It is notable, however, that growers prefer non-returnable packages and are very reluctant to use returnable packages with the National Mark. This indicates a definite advance in marketing practice. It can seldom be advantageous to market graded apples in the same type of package as is used for ungraded supplies.

Labels.—National Mark apple and pear labels seem to have given complete satisfaction to authorized packers and to salesmen, and no complaints have been made on the score of cost or suitability.

General.—The statutory grades and the conditions governing the application of the Mark will be adhered to in the coming season, and there is every indication that the scheme in its present form will continue to operate with growing success and widening influence in the industry.

National Mark Strawberries and Cherries.—Following a consultation on the schemes with the relative Sub-Committee of the National Farmers' Union, it seems unlikely that any restriction will be imposed as to the varieties of strawberries that may be packed under the Mark during the 1931 season.

The question of making further additions to the types of containers which may be used under the National Mark Schemes for strawberries and cherries, including some new types of punnets, is under consideration.

National Mark Cider.—It has been decided, on the recommendation of the National Mark Cider Trade Committee, to modify the condition regarding the total annual "throughput" of cider of all kinds which must be attained by persons or firms desiring to become enrolled in the National Mark Scheme as "authorized bottlers." The "quantity qualification" has now

been fixed at 2,000 gallons per annum, instead of 3,000 gallons as at first proposed. The figure is, of course, tentative and subject to review in the light of experience.

The following additional firms have been recommended for authorization under the Scheme :—

Gloucester : Wickwar Cider Co., Ltd., Wickwar.

Hereford : J. Boulton & Sons, Ltd., Barrs Court Cider Works, Hereford.

H. P. Bulmer & Co., Ltd., Hereford.

London : Wm. Gaymer & Son., Ltd., 581-589 Hackney Road, E. 2.

Norfolk : Wm. Gaymer & Son, Ltd., Attleborough.

Publicity for National Mark Produce.—The first National Mark Shopping "Week" of the year was held at Derby, from February 4 to 14, concurrently with the Derby Homes and Industry Exhibition, at which the Ministry staged a display of National Mark products. The Exhibition was opened by Sir Thomas Middleton, K.C.I.E., K.B.E., C.B., Vice-Chairman of the Development Commission. The "Week" was well advertised by means of hoarding posters and press advertisements; local activities included a window-display competition and an essay competition for the senior school children, for both of which the Ministry offered prizes.

Following the advertisement of the National Mark Egg Scheme in producers' journals towards the end of 1930, advertisements of National Mark eggs were inserted in the principal journals circulating amongst retail grocers and dairymen. Further publicity is also being given to National Mark flour by means of advertisements in certain of the more important newspapers in the Eastern Counties.

National Mark beef is being regularly advertised in Birmingham, Leeds, Bradford and Halifax by means of press advertisements and in other ways, in order to stimulate demand in those areas. One enterprising retail butcher in the London area has had prepared a short film advertising National Mark beef which is being shown in a local cinema theatre for twelve months. This is but one of many instances of individual advertising of National Mark products which have recently come to the Ministry's notice.

Two new leaflets, on the subject of National Mark flour and National Mark eggs, respectively, have been issued by the Ministry. The former—Marketing Leaflet No. 12E—contains a recipe for making bread with National Mark All-English Yeoman flour on a commercial scale, based upon tests, made on behalf of the Ministry by the Director of the National Bakery

School, with a number of samples of flour produced from Yeoman wheat of the 1930 crop drawn from all parts of the country. Arrangements have been made for copies of the leaflet to be placed in the hands of practically every baker in the country. Marketing Leaflet No. 6G is intended mainly for supply to retailers of National Mark eggs for distribution to their customers. It contains some fifty recipes for egg dishes, preceded by the following foreword :—

It is not so many years ago that the breaking of an egg was attended by some amount of speculation as to what the nature of the contents might be. Improvements in marketing methods have, however, raised enormously the general standard of eggs placed on sale. The most notable advance in this direction was made when the National Mark scheme was applied to home-produced eggs of the finest quality.

In a relatively short time National Mark eggs have deservedly gained a prominent place in the markets of the country, even in quarters where formerly home-produced eggs maintained but a precarious footing in competition with carefully selected and graded imported supplies. The reason for this is not far to seek. The consumer always prefers home produce provided that it can easily be identified as such, that its quality is reliable, and its price reasonable.

National Marks eggs are guaranteed to be clean, home-produced eggs of first quality. They are inspected before a high-power lamp before packing, and no stale or defective egg passes this test. After inspection, they are graded into four weight grades :—

SPECIAL weight, a very large, special, breakfast egg.

STANDARD weight, a large egg. Egg-cups are designed for this size and cookery recipes are based on eggs of this weight.

MEDIUM weight, a medium-sized, all-purpose egg.

PULLET weight, a small egg, suitable for children and invalids.

Every National Mark Egg Packer is registered, and his premises and eggs are subject to Government inspection.

Since the quality of eggs is not apparent to the housewife until they are broken, the fact that National Mark eggs are all tested shortly before they leave the packing stations provides a valuable safeguard. It is most important in preparing egg dishes to bear in mind that the consistency of the albumen in the eggs has a very considerable effect on the result. This consistency weakens with age and with depreciation in quality of the egg, and the best results cannot be obtained by the use of so-called "cooking" varieties. By buying National Mark eggs you can be sure of securing home-produced eggs of uniform high quality, clean, sound, graded as to weight, and packed according to the most approved modern methods.

All grades are of first quality : the difference in grades is a matter of weight only. There is a difference of more than $\frac{1}{2}$ lb. between a dozen eggs of "Special" grade and a dozen eggs of "Pullet" grade ; this difference is reflected in the price.

The National Mark is your guarantee of value for money.

Look for it on the egg-case or carton—not on the eggs.

Copies of the above-mentioned leaflets may be obtained, free of charge, on application to the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.

Displays of National Mark and other Home Produce.—At the British Industries Fair, Olympia, London, February 16-27,

part of the England and Wales stand was devoted to a National Mark egg grading and packing demonstration, one of the latest types of grading machine being used. The rest of the stand comprized a representative display of home produce.

The England and Wales occupancy of the Empire Marketing Board's shop in High Street, Birmingham, referred to in last month's issue, came to an end on February 7, after a very successful fortnight. The shop attracted a crowd of visitors every day, and keen interest was displayed by both the general public and the traders of Birmingham. A wide range of home-produced foodstuffs was displayed and samples of many of the commodities were on sale, including National Mark eggs, apples, flour, pharmaceutical malt extract; also canned fruits and vegetables, canned fish, tinned milk, tomato chutney, etc. The total number of separate samples sold was 25,006. An egg grading and packing demonstration, given daily by the Cheltenham Egg Packing Station, proved very attractive; and the Empire Marketing Board's cookery demonstrations were also well attended. There is every reason to hope that the sale of home produce in the Birmingham area will receive a considerable stimulus from this undertaking.

National Mark produce was displayed at the Derby Homes and Industry Exhibition (February 4 to 14) in connexion with the National Mark "Week" held in that town, and also at the Shire Horse Show, Agricultural Hall, London (February 24 to 26).

The Collective Advertising of Dutch Horticultural Produce.—

The following translation of a recent article in a German journal is of special interest in view of the publicity now being undertaken in this country on behalf of National Mark and other home products. The *Preisberichtsstelle beim Deutschen Landwirtschaftsrat* reports:—

For a good many years past, the management of the co-operative auctions in Holland have had in operation a system of collective advertising for Dutch produce such as vegetables, fruit, potatoes and, in certain cases, flowers. An advertisement fund has been created which derives its income from contributions made by the co-operative auction markets. The contribution consists of $\frac{1}{100}$ per cent. of the turnover during the previous year. In the year 1930, the receipts from this source amounted to 46,000 Dutch florins (approximately, £3,805); from the previous year there was a surplus of 17,000 fl. (approximately £1,406), which, together with reserves, resulted in a total sum of 77,000 fl. (approximately £6,370), being available.

In North Holland, 10,000 fl. (approximately £827) were devoted to the advertisement of the produce of the province, and, in Westland, a special fund of 7,000 fl. (approximately £579) for the advertising of grapes was contributed by the 12 co-operative auctions that have formed a special society in that province. The particular advertising campaign financed from these two sources extends to cabbages, tomatoes and grapes. The methods used included the sending of samples of cabbages to America and England, of grapes to India, of tomatoes to America, and of early potatoes to the Rhineland and to Westphalia. In the latter case, and in order to interest wholesale and retail dealers, extended use was made of advertising posters on pillars and walls and of advertising cards.

The collective advertising organization, referred to in the first paragraph of this note, made use, for the most part, of time-honoured methods. For furthering consumption in Holland, 500,000 pamphlets containing recipes were distributed to retailers; posters, advertisements on business letters and on envelopes, and other similar means were utilized, including illuminated signs in the large towns.

Dutch opinion regards the results as good. Particular attention was given to the display, in trains and trams, of seasonal advertisements for special produce. As soon as a particular Dutch horticultural product came into season, advertising cards were hung up in the trams in the large towns, and also in business houses or on the railway, drawing attention to it. For example, this plan was adopted during the season for hot-house tomatoes and for tomatoes grown under glass without heat. The general opinion was that, in the case of tomatoes, noticeable success was achieved. It should be mentioned, however, that, in the case of tomatoes, advertising posts in the streets were widely used. With grapes, illuminated advertisements in the main street of the seaside resort of Scheveningen were employed.

Advertisement abroad appears to the Dutch to be specially necessary, because consumption abroad has decreased in the last few years on account of the difficult economic situation in those countries that have been regarded as the chief market for Dutch produce. Holland took part in the exhibition in Zürich, with the result that Switzerland became an important consumer of Dutch produce. Holland also took part in the exhibition in Antwerp. Advertising posters for Dutch wares were also distributed in foreign countries and particularly when the season for important Dutch produce was beginning.

Marketing Grants.—In the issue of this JOURNAL for September, 1930 (pages 597–8), there appeared a list of grants authorized by the Ministry up to the end of June, 1930, out of funds made available by the Empire Marketing Board for the improvement of marketing of agricultural produce. Applications for grants of this nature have to be supported by evidence indicating that the venture contains some novel element and that it involves a commercial risk that would not normally be accepted by the applicant. Grants may also be made either in aid of specific items of marketing research undertaken on the Ministry's behalf or in return for certain services.

The following further sums have been granted by the Ministry during the half-year ended December 31, 1930 :

Amount	To Whom Payable	Purpose.
*£42 for 1 year to March 31, 1931	Wiltshire Egg Producers, Ltd.	To provide costings data in respect of egg packing station.
*£42 for 1 year to March 31, 1931.	Norfolk Egg Producers, Ltd.	Ditto.
*£42 for 1 year to June 30, 1931.	Cumberland Poultry Farms, Ltd.	Ditto.
*£42 for 1 year to March 31, 1931.	Melton Mowbray and District Farmers' Association.	Ditto.
*£31 10s. for nine months to March 31, 1931.	Gloucestershire Marketing Society, Ltd.	Ditto.
*£680 for 1 year to Sept. 30, 1931.	University College of Wales.	Marketing (advisory and statistical) investigations.
*£800 for 1 year to September 30, 1931.	Cambridge University.	Pig recording.
*£688 for 1 year to July 31, 1931.	Oxford University (Agricultural Economics Research Institute).	Investigations into the marketing of farm produce.
£350.	Shenley Poultry Products, Ltd.	To meet additional costs incurred while acting as a poultry packing demonstration centre.

* These are in continuance of grants previously made.

Compulsory Marketing in Queensland.—The latest Report of the Director of Marketing is a brief résumé of the operations of the fifteen commodity marketing boards in Queensland during the year ended June 30, 1930. These boards have been established under the Primary Producers' Organization and Marketing Acts, 1926–1928, and the Fruit Marketing Organization Act, 1923.

The past year has seen interesting developments in one or two commodities. Barley producers in the past have been unable to secure the whole of the brewers' trade in malting barley. This has not been because of the poor quality of the malt from Queensland barley, but rather because of the inability of the home producers to furnish an adequate supply from year to year. To remedy this the Barley Board was established, and already an arrangement has been made between the brewers and the board for the disposal, for malting purposes, of the whole of the unsold portion of last year's crop. It is expected that all the malt used in Queensland will, in future, be made from Queensland barley.

The Cotton Board during the past year has acquired the ginning plant of the British-Australian Cotton Association. The ginning and oil-milling operations will now be under the control of the Board.

The Wheat Board has come to an agreement with the milling interests for the purchase of between $3\frac{1}{2}$ and 4 million bushels of Queensland wheat at prices based upon Sydney quotations.

Ownership of the various commodities is vested in the boards, but in most cases the pooled crop is marketed through the ordinary trade channels; the activities of the boards are chiefly confined to regulating the volume of supplies going on to State, inter-State, and overseas markets, providing for equalization payments to producers and fixing the commission charges to be made by the marketing agents.

It is regarded as evidence of the general satisfaction on the part of the producers that no board once established has been discontinued. In the case of some commodities, *e.g.*, butter and cheese, the boards have been renewed for further periods without any opposition, and in other cases ample majorities in favour of continuance have been forthcoming.

The Mark Potato Movement in Germany.—The German "Mark Potato Movement," which was briefly described in these pages in the issue of March, 1930 (p. 1193), has progressed steadily since its inception two years ago. The Hanover Mark Potato Association, which was the pioneer in the movement,

increased its sales from 120 truck-loads in 1928 to 250 in 1929, and to 280 up to November 20 in 1930. Similar organizations are now operating in the Provinces of Westphalia, Saxony and Silesia, and the Free States of Lippe, Saxony, Wurttemberg and Bavaria. As the result of a joint agreement, all the Mark Potato Associations are now marketing their produce under the same standards as those originally established in Hanover. They have adopted, in addition, a uniform "Eagle" brand with the words "German Mark Potatoes," in conjunction with a special Association Mark in each case, as shown, on the specimen label reproduced below.



Kontrollnummer:

NOTE: The buff-coloured label is printed in black with the exception of the shield which is red, the figure of the horse showing buff on this.

In the control system of the Mark Potato Associations, an attempt is being made for the first time in Germany to give buyers of potatoes some guarantee of uniformity of variety and dressing in their purchases. Certain varieties only are permitted to be sold under the Mark, and there is strict

inspection both of the growing crop and of individual consignments. This implies in some measure a guarantee of eating quality, although it is recognized that, in this respect, the influence of such factors as soil, manures and methods of cultivation is not yet adequately understood.

Special care is taken to market the potatoes in as attractive a way as possible. They must be sold in new, sealed sacks, each bearing a branded label with a control number. An interesting recent development is the sale of Mark potatoes in 5-lb. and 10-lb. paper packages bearing the Mark; although this trade is still in the experimental stage, it appears to promise well and to meet a definite demand on the part of the German housewife.

The success of the Mark Potato Movement must depend ultimately on whether the producer is adequately rewarded for the extra costs of producing a high-grade commodity. Hitherto, this appears to have been achieved, and the trade has willingly paid a premium for Mark Potatoes, averaging about 6d. a hundredweight without sack; as against this, it is estimated that the extra cost of preparing Mark Potatoes for market amounts to about 4d. a hundredweight.

Strictly speaking, the Mark Potato is a luxury article, to the preparation of which very special care has been applied. The supplies have come hitherto, and are likely to continue to come, from a small minority of the most capable and progressive producers, consisting largely of seed-potato growers who are accustomed to the observance of a very high standard. In spite of its valuable educational effect on growers and the trade, the German Mark Potato Movement has apparently its limitations under existing conditions.

Potato "Futures" Exchange.—The first "futures" exchange for potatoes in the world has been started in Chicago, according to the bulletin of the *Preisberichtsstelle beim deutschen Landwirtschaftsrat*. The first business done was in March deliveries of Idaho Russets, the most popular American variety. The official U.S. No. 1 grade has so far been recognized as a satisfactory basis for deals in futures. Prices are quoted in dollars per 100 lb., and the smallest unit that can be dealt in is one wagon of 360 sacks of 100 lb. each. Delivery must be made to one of the two goods stations in Chicago.

This experiment should certainly be closely watched by the potato trade, and especially in Europe, where, except for grain, there has hitherto been practically no organized trading in

futures in any locally grown agricultural produce. It will be interesting to see whether potatoes, which are so much more perishable and difficult to grade and transport than grain, can, in the long run, be successfully handled on a "futures" market, and whether a stabilization of prices will result.

The American Marketing Act.—The following excerpts are taken from a Press release of an address by Mr. Alex Legge, Chairman of the Federal Farm Board, to the College of Agriculture, University of Illinois :—

"The prime object of the Agricultural Marketing Act is to place agriculture on a basis of economic equality with other industries. Producer co-operation is the chief means provided for bringing about that result. Our job, as well as that of all other agencies interested in the betterment of agriculture, is to assist farmers in every way possible to make the co-operative programme effective."

"The Agricultural Marketing Act offers Government assistance to the farmer in obtaining what are, perhaps, his greatest and most immediate needs—a marketing system operating in his interest and the adjustment of production to the probable consumer-demand. Of these, perhaps the more important is the latter, for even a perfect marketing system will not return the grower a satisfactory price if he produces a quantity far in excess of the market demand. On the other hand, production of the quality and quantity that the consumer wants will not give the best results unless the marketing machinery is operating in the interests of the producer. The attainment of both, we believe, becomes reasonably easy through organization, but appears hopeless with 6½ million farmers acting individually and without regard to what their neighbours are doing. Organization has been recognized as a necessity in other lines for a long time. To be on an equality with highly organized industries, farmers, too, must be organized."

"This Act is not a relief measure. Congress discarded all the proposed schemes for artificially raising the price of farm products in favour of a plan to assist farmers, acting collectively, to control their industry and put it on a sound financial basis. In this Act, Congress says to the American farmer that the Government stands ready to help him just as far as he is willing to go in controlling his own industry."

THE CONTROL OF THE CABBAGE ROOT FLY

HERBERT W. MILES, M.Sc., Ph.D.,
Victoria University, Manchester.

OF the insect pests that occur in more or less serious numbers each season, none is more persistent in its attacks or occasions greater loss than the Cabbage Root Fly (*Chortophila brassicae* Bohé). This insect has received a good deal of attention during the last quarter of a century, and a fairly detailed knowledge of its life history and habits has been worked out.* Several methods of control have been advocated from time to time, and some of them have proved quite efficient under experimental conditions. In spite of this, however, severe injury to market garden and field crops is still prevalent, and in general little is done towards checking the loss.

Host Plants.—Cauliflowers appear to be especially susceptible to attack by the Cabbage Root Fly, possibly because the time of setting out in the early summer coincides with the appearance of the spring swarm of flies, and the drought that is often a characteristic of this season prevents the plants becoming established quickly and renders them less resistant to insect attack. Summer cabbages are subject to severe infestations, and turnips, swedes and radishes are commonly attacked. Other plants that may be attacked from time to time are autumn-set cabbages, Brussels sprouts and Swiss chards, and such flowers as wallflowers and stocks. Weeds also harbour the pest, and among the wild host plants are charlock, wild mustard, garlic mustard and shepherd's purse.

Types of Attack.—In the most common form of attack, the eggs are laid either singly or in small clusters in cracks in the soil near the plants, or in the crevice around the stem when the wind has slightly rocked the plants. On hatching, the maggots descend to the base of the stem and feed among the young roots near their junction with the main roots and the stem (Fig. 1). As the maggots develop, they destroy the roots until only a blackened, decaying, snag-like root devoid of lateral branches is left, and the maggots may be found more or less embedded in the decaying stem tissue.

A second type of attack occurs on turnips and radishes where the maggots make tunnels in the fleshy "roots." This mode of attack is fairly general, but does not seem to cause such serious losses as attacks on cabbages and cauliflowers. Possibly

* *Vide* Ministry of Agriculture Advisory Leaflet No. 18.

owing to the rapid growth made by these plants the maggots seem to have difficulty in finding suitable food, for they wander extensively in the tissue of the host plant and appear to do a considerable amount of feeding before reaching maturity. Similar winding tunnels may occur in the fleshy stems of cabbage and cauliflower plants, but this is not normal and the injury is practically negligible.

A third form of attack by the Cabbage Root Fly occurs when the eggs are laid, not in the soil, but somewhere about the head of the plant. On hatching, the maggots work their way into some suitable site in the upper part of the plant. This type of attack has not been widely observed, but was noted on cauliflowers in Lincolnshire in 1923,* and has occurred on swedes in Lancashire and North Cheshire during the seasons 1928-30.†

In the attack on cauliflowers, the maggots were found tunnelling in the fleshy branches of the curds. The infested plants produced open curds and were consequently unmarketable, and the bacterial rot which followed the maggot injury accentuated the loss.

In July, 1928, the writer's attention was drawn to a yellowish, moist rotting about the growing points of half-grown swedes, and examination showed that the rot appeared to be the result of attack by maggots which, when bred out, proved to be Cabbage Root Fly. The maggots were tunnelling into the fleshy bases of the leaves and often into the "root" below the growing point, six to ten maggots occurring on a single plant. As the result of the attack some putrefaction occurred amongst the swedes, but did not become serious because the season was dry. Many plants could be found in which the terminal bud was destroyed and a small hole, often hidden by the growth of axillary buds, led into a larger cavity in the neck of the swede (Fig. 2). When the crop was lifted approximately 60 per cent. showed more or less serious rot penetrating from the neck inwards. Subsequent observations of other swede crops showed that similar attacks of varying degrees of intensity occurred throughout Lancashire and North Cheshire.

In 1929, eggs of the Cabbage Root Fly occurred from early June onwards until early September on the upper surfaces of the stems of swedes, usually singly or in twos. The maggots entered the stems near the point where the eggs were laid, or wandered down and entered near the axil. In some instances, the maggots tunnelled through the stem from the upper to the

* Annual Report, Kirton Agricultural Institute, 1923.

† *Agricultural Progress*, Vol. VII, p. 54.



FIG. 1. Normal attack by maggots of the Cabbage Root Fly Summer Cabbage
plant with maggots feeding on the root

THE CONTROL OF THE CABBAGE ROOT FLY.



FIG. 2. Cavity in neck of Swede following attack by maggots of the Cabbage Root Fly. Bacterial and other rots followed the initial wound caused by the maggots.



FIG. 3. Gaping wounds with yellow and brown decaying tissue in leaf stalk of Swede following entrance and attack by maggots of the Cabbage Root Fly.



FIG. 4. Result of treating cabbageworms with corn-leaf-sucking to prevent attack by the Cabbage Root Fly. An untreated check row is seen through the treated rows.

lower surface, and in others they entered the stem and turned downwards towards the base. At the point of entrance of the larvae, a circular or elongate wound developed, which gradually became filled with loose brown rotting tissue (Fig. 3). When the point of entrance was distant from the axil, the maggot reached maturity in the leaf stalk, but, when it occurred near the base, the maggot frequently tunnelled beneath and destroyed the terminal bud. The destruction of the terminal bud resulted in the development of axillary buds and caused a many-necked condition like that associated with attack by swede midge. Sometimes a bottle-necked condition occurred, similar to that described by Walton* as following midge attack. As a result of attack by Cabbage Root Fly, the swede crops in the north-western counties suffered severely from "neck rot" both in the field and, later, in storage.

Control Measures.—Among the control measures constantly recommended are the judicious rotation of crops, the avoidance of excessive cropping with cruciferous crops and the thorough cultivation of the land in autumn and winter. The value of inter-cultivation, hoeing, earthing-up and applying light dressings of forcing artificial manures is also well known, and, on most successful market gardens and holdings, close attention is paid to these operations. The value of insecticidal treatments is, however, less well known and forms no part of general practice. During the past three years, demonstrations of direct insecticidal and repellent treatments have been carried out in Lancashire and Cheshire and convincing results obtained.

The Use of Corrosive Sublimate.—Corrosive sublimate or bichloride of mercury was mentioned in connexion with the control of Cabbage Root Fly as long ago as 1864, but it is only within the last 15 years that serious attention has been given to its use. It is now the standard control measure in America and Canada, and appears to be consistently beneficial. It is a white crystalline powder that dissolves very slowly in water. Being highly poisonous, it must be handled with great care, and since it corrodes metals it should be used in enamel, wooden or glass receptacles. Though toxic to plants when used at high concentrations, it is harmless when used at dilutions of 1 in 2,000 or 1 in 1,000.

The following procedure has been adopted for small-scale work in gardens. The corrosive sublimate was weighed out into $\frac{1}{2}$ oz. lots and packeted. Each $\frac{1}{2}$ oz. packet was sufficient for $2\frac{1}{2}$ gal. of water, this amount being chosen for convenience of

* This JOURNAL, September, 1927, p. 547.

mixing in a 3-gallon pail. After thorough stirring, to dissolve the corrosive sublimate, the solution was applied by means of a small tin pressed out to form a lip and nailed to a strip of wood about 18 in. long. Such a ladle proved very satisfactory for the application of the solution. About $\frac{1}{2}$ pint was allowed for each plant and applied so as to flood the soil evenly around the base of the plant. The solution was applied three to five days after the setting of the plants and repeated, at least twice, at intervals of seven to ten days.

For market garden use, where a larger area was to be treated, the solution was made up in a 40-gallon barrel, 4 oz. of corrosive sublimate being dissolved in hot water and added to complete the bulk.

In the accompanying table, details are given of the results of one of the demonstrations carried out in 1929 on cauliflowers (Fig. 4) :—

<i>Plot</i>		<i>Healthy plants</i>	<i>per cent.</i>	<i>Injured plants</i>	<i>per cent.</i>
No. 1—					
Treated	.. ..	290	94.1	18	5.9
Control	.. ..	31	44.3	39	55.7
No. 2—					
Treated	.. ..	296	96.1	12	3.9
Control	.. ..	18	28.1	46	71.9
No. 3—					
Treated	.. ..	317	92.9	24	7.1
Control	.. ..	36	62.0	22	38.0

Average for treated plots 94.4 per cent. healthy ; 5.6 per cent. attacked.
 Average for check plots 44.8 „ „ 55.2 „ „

In 1930, a similar demonstration was conducted under market garden conditions, and records were kept of the materials used and the time required. The following are the details :—

40 gal. of solution containing 4 oz. corrosive sublimate

Number of plants treated	.. ..	1,200
Approximate quantity for each plant	.. ..	$\frac{1}{2}$ pint
Total cost of solution	.. ..	2s. 10 $\frac{1}{2}$ d.
Cost of solution for 1,000 plants	.. ..	.. .. 2s. 5d.
Time required for treatment: two men working one hour :—		
Cost, at 9d. per hour..	.. ..	1s. 6d.
Cost of labour for treating 1,000 plants	.. ..	1s. 3d.

Total cost of labour and solution for 1,000 plants.. .. 3s. 8d.

In this demonstration, the number of attacked plants was reduced from 47 per cent. to 13 per cent. by a single treatment ; thus an additional 300 plants were available for marketing in each 1,000 set out.

These demonstrations give definite indications of the value of corrosive sublimate against the Cabbage Root Fly and, where the method can be employed, it is well worth adoption as a routine treatment. For small scale operations, where it is thought inadvisable to purchase quantities of corrosive sublimate in powder form, the material can be obtained from chemists and druggists in tablet form. Four tablets per gallon give the required concentration of 1 in 1,000.

The cost of the corrosive sublimate treatment and the difficulties attendant on the employment of a liquid render this method of controlling Cabbage Root Fly unsuitable for application on a field scale. There is, therefore, a need for a simpler and cheaper method of control, and to meet this need experimental work is in progress at Manchester University. Preliminary trials have been carried out, using naphthalene, applied in dry crystalline form, and commercial, light creosote absorbed in precipitated chalk, and other suitable carriers. Both these materials have given indications of their value as repellents when applied a day or two after setting out the plants, the dressing being repeated, at least twice, at weekly intervals. The naphthalene is applied by hand to the soil about the plants, 15 lb. being sufficient for a single dressing for 1,000 plants. The creosoted chalk dust is applied by means of a knapsack duster, 2 lb. being sufficient to treat 1,000 plants at each application. Should these materials, upon further investigation, prove satisfactory, they will be suited for use as repellents against Cabbage Root Fly on cauliflowers, cabbages and swedes grown under ordinary field conditions.

The writer's acknowledgments are due to Messrs. N. J. Macpherson and W. L. Steer for their assistance with the field demonstrations and trials, and to Mr. C. P. May for help with the survey of swede injuries in Lancashire. The writer is also grateful to Mr. J. J. Green for his interest in the work and for furthering the investigations.



A young American Pekin Drake This bird is pure white in colour, weighs about 11 lb, and has the typical
Pekin carriage
Photo. Feathered World

finement, lasting about 24 hours, they are allowed to run outside in pens specially partitioned off for each batch. As the young ducks develop, they are passed on through the several compartments that comprise the brooder house, remaining about one week in each. The last compartments hold the birds reaching the killing stage and are not artificially heated. Sandy earth is used on the floors of the brooders, which are cleaned out at regular intervals, the earth being renewed. The grass run to each compartment is, by a careful arrangement of hatches, allowed a short period of rest before being restocked. The land, which is light and sandy in character, is well drained, and the actual paddling of the ducks helps to tighten up this light soil, and, to some extent, improves its moisture-holding capacity. The herbage, which is poor, is also improved in some degree by running the ducks on the land.

The continuous stocking of the runs with ducks does not appear to affect the health of the young birds in any way. Ducks suffer from very few diseases, and, as a general rule, their health gives little cause for anxiety.

Soon after hatching, the ducklings are given a fattening ration which includes white maize meal, barley meal, and semi-solid butter milk. This last ingredient no doubt helps to make the flesh of the Pekin approximate to the whitish character of that of the Aylesbury.

The birds are killed when they reach a weight of about 6 lb., usually attained in about eight weeks from the date of hatching. They are rough-plucked, tied down, and sold in Leadenhall Market. The owner claims to average 1s. profit on every duck marketed, and considers that the prices obtained are good and well above those usually obtained for the ordinary class of duck. They do not, however, exceed the prices given for first-class Aylesbury ducks, which sometimes realize as much as 3d. per lb. more than that given for Pekins.

The Pekin's hardiness, excellence of flesh and rapid growth, together with its ability to produce a large number of hatching eggs, are considered by the owner of this farm to outweigh the disadvantage of the orange colouring of the beak and legs. It is the intention to develop the farm so that it will be capable of producing 6,000 table ducks a year.

[For the accompanying photographs of the Pekin ducks referred to above, which are the property of Captain Roland Hewitt, M.C., Roxhall Farm, Foxhall, Ipswich, the Ministry is indebted to the Editor of *The Feathered World*.]

COUNCIL OF AGRICULTURE FOR ENGLAND

THE Thirty-fifth Meeting of the Council was held on Thursday, February 12, 1931, at the Middlesex Guildhall, Westminster, Mr. Denton Woodhead being in the Chair. The Parliamentary Secretary, Lord De La Warr, and the Permanent Secretary to the Ministry, Sir Charles Howell Thomas, K.C.B., C.M.G., were present.

Agricultural Marketing Bill.—Arising out of the Minutes *Lt.-Col. Sir Merrik Burrell, Bart.* (West Sussex), on behalf of the Chairman of the Standing Committee, Sir Arthur Hazlerigg (unfortunately prevented from attending through ill-health), raised a question as to the changes which had been made in the Marketing Bill since the Council reported upon it at its last Meeting. Sir Merrik said that the Council had given considerable support to the Marketing Bill at that time, but certain changes had been made in the Bill and the Council was now in the position of having given its approval to something which had been altered without its knowledge. He thought it right for the Council to have an opportunity of expressing an opinion on the situation.

Lord De La Warr said that he was glad the point had been raised. There had been a number of minor amendments, many of a drafting character, and there had been one large addition to the Bill, namely, Clause 13, which gave the Minister power to set up what was called a "Re-organization Commission." The reason why it was included was that the schemes which producers would have power to draw up would, in some cases, be of an extremely complicated character and producers ought to have help to do this. The Clause did not alter the voluntary character of the Bill in any way whatever. The Commission would be required to report to the Minister, who would then bring the report to the notice of producers. It put the Minister in the position to offer to the Industry first-class advice from the outside, for them to adopt if they wished.

The Ministry did not consider the Council in any way bound by any resolution to have approved the Clause. It had not been found possible to insert in the Bill any provision as to control of imports, as the Council had suggested, but that did not preclude either this Government or any other Government at a future date from dealing with the problem. As the Bill stood, it did put the producer in a very much better position to compete with the foreigner than he was in at the moment.

As regards other resolutions passed at the last Meeting of the Council, that of Mr. Sampson calling upon the Government and the Leaders of the Opposition to meet together to discuss the question of the ruinous state of Agriculture, and Mr. Cox's resolution to take immediate steps to prevent "dumping," both had been carefully considered, but it had not been found possible for the Government to take action on the lines suggested. As regards Mr. Robinson's resolution concerning insecticides and fungicides—the need for manufacturers to give a declaration of strength—a conference had been called as a result of it, and the Ministry was hopeful that it would be possible to take definite steps before very long. The other resolution on the question of prosecutions under the Fertilizers and Feeding Stuffs Act, 1926, was the subject of a Report to this meeting of the Council from the Standing Committee. *Sir Merrik Burrell* said, with regard to the Agricultural Marketing Bill, that Clause 13 had, in some way or other, created an antagonistic atmosphere to the Bill, and he would like to see this undesirable effect removed. *The Chairman* said that the Standing Committee would watch the Marketing Bill in its later stages on behalf of the Council.

Marketing of Home-Produced Cheese.—*The Chairman*, on behalf of *Sir Arthur Hazlerigg*, Chairman of the Standing Committee, moved the adoption of the Report on the Marketing of Home-Produced Cheese. In doing so, he said he was quite sure that it would be the wish of the Council to convey to *Sir Arthur* its deep regret at his inability, through illness, to be present, and its hope for his speedy recovery. He also thought that the Council might wish to congratulate *Sir Arthur* on his appointment as this year's President of the Royal Agricultural Society. (Hearty assent was expressed.) *The Chairman* then moved the adoption of the report (for text see *Appendix I* to this article, p. 1242). He said, in the course of his remarks, that cheese producers had very little organization from the trading point of view, and that seemed very necessary for them to acquire. The public, too, should be brought to realize that English products ought to have their first attention, even before those from the Dominions. English cheese was the best that could be obtained. We imported, however, 186,000 tons or about three-quarters of our requirements. The home industry should make more cheese, and regain this market, using up more surplus milk, and thus tend to stabilize the milk industry. The Agricultural Marketing Bill should help in organizing the cheese industry.

Mr. Wm. McCracken (Cheshire) complimented the Committee on the admirable Report presented. Producers in Cheshire had been struggling hard to raise the average quality of Cheshire cheese and to market it. Two grades would be put upon the market under the new scheme of co-operative grading. These would be marked with the Federation's mark, and the National Mark when it came to be used would, he thought, rather interfere with the local grade mark, and be detrimental to the local work. He appealed to the Ministry to give close attention to this matter in order to help on what had already been done and was being done. *Mr. H. B. Boden* (Staffs.) thought that grading schemes in the present state of Agriculture were rather putting the cart before the horse. To prepare articles for sale ready for the day when they could be sold was not good. The Report was lacking in that there was nothing in it to encourage the farmer, who always reflected that farm goods were produced under different conditions in this country from those existing abroad, where there was, for example, no control of the producer in respect of wages. *Mr. A. E. Bryant* (Bucks.) said that he was not sure as to the truth of there being over-production of milk. The feeding of a larger number of calves was widely advocated, but in spite of this very large numbers were slaughtered. A large cheese buyer had informed him that he could buy foreign Cheddar which was as good as, if not better than, any English. The poorer people would buy the cheapest cheese every time. *Mr. W. Holmes* called attention to the comparatively high wages paid in Holland, which country, with other farm charges in proportion, could export cheese and beat ours in our own market. The same could, he thought, be said of Canada, New Zealand, and Australia. He was therefore in favour of testing out schemes of organization for the British farmer. He congratulated the Committee on bringing the Report forward. *Mr. W. B. Taylor, M.P.* (Norfolk), said he found himself in general agreement with the Report. On the wider issues of marketing, he was doubtful whether control of imports was practical politics or good business at the present time. In any case, the purpose of the Council should be to help build up step by step on every practical issue that came along, and not to hinder or discourage by reaching out for something that was not practical at the moment.

Mr. W. W. Sampson (Dorset) asked whether, in the comparison of Holland with England, Mr. Holmes could say anything as to regulated hours of labour. There was great difference in a country organizing home production for a home market and a

country organizing for an export market. *The Chairman* ruled a discussion on wages and hours out of order on the present motion.

Mr. Clement Smith (East Suffolk) stressed the point that experts who knew said there was nothing better than cheese from individual farms, carefully and properly made. At the same time, only 25 per cent. of our home-produced cheese could be placed in the first class. There was, therefore, plenty of margin for improvement in 75 per cent. It might be found very difficult to apply the National Mark satisfactorily to cheese, which varied so much in forms of excellence, and while the public taste also varied so much : still he thought the difficulty could be overcome. He had seen cheese made in Holland, and a good part of the butter-fat taken off the milk first. *Mr. R. P. Allsebrook* (Leicester) agreed that there was no cheese like farmhouse cheese, but to-day the women were not so eager to turn out the product from the farms. Cheese-making was hard labour seven days in the week, early and late, and it should be paid better than it is. He thought the only hope was to get it made collectively in farms or factories in the future.

The Chairman then replied to the debate. He pleaded for fair play in competition with imported cheese, which should be sold in our markets only for what it is : given that and the National Mark, English Cheese would hold its own with any cheese in the world. The time might come when fish and chips would be discarded in favour of good English cheese, home-brewed ale, and bread made from English wheat.

The Report was then adopted by the Council.

Prosecutions under the Fertilizers and Feeding Stuffs Act, 1926.—*Mr. Cecil Robinson* (Holland) moved the adoption of the Report from the Standing Committee (see *Appendix II* to this article, p. 1249). He called attention to the circumstances under which the Report had been prepared, and stated the conclusion of the Committee that it was better to publish the present position widely, and wait to see what occurred within the next twelve months or so. *Mr. J. M. Paine* (Bucks.) objected to the Report, and considered that it should have advocated amendment of the Act. He thought it was against the evidence. *Lord De La Warr* said that, on matters of this sort, the Minister acted as far as possible in agreement with the persons concerned. It was only a few years ago—in 1926—that an agreed measure was introduced, and it would upset that agreement if changes were now proposed. The Minister was quite prepared

to take the action recommended in the last paragraph of the Report and circularize Local Authorities, asking them to redouble their efforts. After a further working period of control, if the Act proved a failure, steps could fairly be taken to amend it.

The Report was then adopted by the Council.

Warble Fly Extermination.—*Sir Merrik Burrell* moved the following resolution :—

“ That the attention of members of the Council be drawn to the Report of the Leathersellers’ Company’s Warble Fly Committee, a copy of which has been placed before each member. The Council considers (a) that all farmers and stock breeders who have dressed their cattle during the Warble season of 1930 should be urged to do so again in 1931 so that the enhanced effect of continuous treatment be observed ; (b) that County Agricultural Committees of Counties where no eradication work has hitherto been done should at once take steps to carry out the suggestions of the Warble Fly Committee for experiments and action in clearing out Warbles ; and (c) that County Agricultural Committees should, through their officials and in any other ways open to them, do all they can to secure that all other cattle owners should take similar action.

The Council regards the matter as of importance to farmers from several points of view, the chief of which is that the money return for beasts sold for slaughter is likely to be increased as regards both the soundness and quality of the meat, and of the hides, if Warbles be eradicated.”

The motion was seconded by *Mr. J. S. Gibbons* (Gloucester). Both mover and seconder informed the Council of their own great interest in the matter, and urged members of the Council to move others in their counties into taking action on the lines suggested in the Leathersellers’ Company’s Report. *Mr. Gibbons* stated that the Irish Free State Government were considering the question of taking similar action to that in this country. The Government of Northern Ireland were already taking action. This was a great encouragement to all those in Great Britain who were earnest on this subject. *Mr. H. W. Thomas* (Hants) supported the resolution. Experience in his own county had convinced many farmers of the utility of taking the action suggested. *Mr. R. P. Allsebrook* supported the resolution from the milk farmer’s point of view. “ Gadding ” stopped the milk-flow of cows. He did not think the Warble Fly moved long distances, and if a farmer dressed his cattle, as he himself had done for years, the fly could be eradicated in a comparatively small area provided other cattle were not brought in with the fly in them.

The resolution was put to the Meeting and carried.

Licensing of Bulls.—*The Rt. Hon. Lord Strachie, P.C.* (Somerset), said that, in view of the decision taken by the House of Lords on the previous day in favour of Government control of the licensing of bulls instead of local control, he was prepared for the present to accept that decision, and that he would not move the resolution which had stood on the Agenda in his name. The resolution was accordingly withdrawn.

Agricultural Land (Utilization) Bill.—*Mr. James Donaldson* (Oxford) moved the following resolution :—

“That the Council of Agriculture for England is of opinion that the Agricultural Land (Utilization) Bill now before Parliament does not afford to the Agricultural Industry the assistance which it now urgently requires, and believes that if the money to carry out its provisions be available it could, with advantage, be utilized for some other purpose more useful to the Industry.”

He said that from a practical knowledge of the present dire straits, both of the farmer and the small-holder, and from the fact that there was nothing in the Bill which would ameliorate this position, there was no advantage in the Bill for agriculture. He objected to the Bill first as regards cost, which might run into millions. There was unlimited power to borrow for all expenditure of a capital nature. At an estimated cost per small-holding of £1,100, 125,000 might be created. Then there were allowances for small-holders while being trained. Other large expenses occurred in regard to large-scale farms and demonstration small-holdings, cottage-holdings, and allotments. The success of large-scale farming in the United States and Canada rested upon the price of wheat: with wheat at 60 cents a bushel, much of it would have to be given up. The experiment had been tried also in this country under Government control and had proved a failure. As regards small-holdings, Mr. Donaldson said that to put an unemployed man on the land to-day and do everything for him would put him in the most favourable competition with existing small-holders, many of whom had lost most of their capital and were living in little short of slavery. This anomaly would make the position of County Councils impossible. If, therefore, money for the purposes of the Land Bill could be found, it could, he thought, be put to much better use. First of all, he would say stop “dumping”, and then stabilize your price.

The motion was seconded by *Brig.-Gen. H. Clifton Brown, M.P.* (West Sussex), who said that he could not see how the Bill could help agriculture. The compulsory taking of land for the purposes of the Bill would destroy confidence, which at

the present moment was needed more than anything else. The Bill was certain to increase administrative and technical staffs. The whole Bill was a blank cheque and a leap in the dark. In the Report of the International Labour Office, at Geneva, dealing with mechanized farming and labour, it was stated that in Canada the combine harvester-thresher operated by 2 men cuts and threshes 40 acres of grain a day; a farm which formerly took 30 men in spring and another 120 to 150 during harvest, now employed only 14 men throughout the year. Large-scale farming was, therefore, not likely to help employment. The anomaly between the two sorts of small-holders, the new under the Bill and the old under previous Acts, ought certainly to be dealt with before the Bill was further considered. *Mr. W. B. Taylor, M.P.*, said that whilst admitting that the Bill was not, nor had it ever pretended to be, aimed at removing existing difficulties in agriculture, it did aim at relieving unemployment. In the last few years 100,000 men had disappeared from the soil, and there were over 2,000,000 unemployed men in the towns. He thought it was essential that the Government should find employment for suitable men on suitable land. As regards large-scale farming, that did not touch unemployment seriously, though it was true that one type of large-scale farming might reduce labour on a rationalized system. *Sir Merrik Burrell*, on behalf of the Standing Committee, explained that the Committee had never looked upon this Bill as an agricultural one. It was rather envisaged as a Bill to relieve unemployment. It might better have been brought in by the Minister of Labour. *Mr. Alexander Goddard* said that the setting up of an Agricultural Land Corporation to undertake farming on a wide scale was an experiment which might be justified if the country were enjoying full prosperity, but certainly was not justified at a time when every item of expenditure should be scrutinized to see if it is productive or not. The second proposal to acquire land for reconditioning and for demonstration farms was also beside the main issue in to-day's circumstances. As regards small-holdings, the cost of which he put at £1,500 per holding, that proposal put the cart before the horse when the man did not know how to make a living out of a small-holding.

Sir George Edwards said that the workers had never received the Bill with open arms. He thought it was unlikely to alleviate unemployment or to increase the number of men employed on the land. The Government, instead, should bring in an Unemployment Insurance Bill; that would help

the worker and agriculture. *Lt.-Col. G. J. Acland-Troyte, C.M.G., D.S.O., M.P. (Devon)*, supported the resolution, as also did *Mr. R. G. Patterson, O.B.E. (Staffs.)*, and *Mr. W. Holmes*, who said he would not have taken much exception to the Bill if, first of all, there had been some protection given to the agricultural workers in the shape of unemployment insurance. *Mr. G. E. Hewitt* and *Mr. J. C. Buttle* also supported the resolution, and *Mr. Haman Porter* agreed, saying that as a small-holder he had worked 200 days last year for no financial return at all. *Mr. John Beard* said he would not vote for the resolution, as the Bill aimed at making better use of the land than is being made of it at the present time. He would rather see men try to understand a new occupation than see the very soul go out of them in going to the Labour Exchange day after day without result. *Mr. Bryant* and others also spoke upon the motion.

Lord De La Warr, replying on behalf of the Minister, said that he did not propose to deal with the rather more political sides of the question that had been raised. The disagreement that was felt about this Bill was going to make it more difficult to pass, and was regretted, though as the Government had begun upon it, being convinced that it was the right policy, they would take full responsibility and stand by it. Agriculture had a contribution to make to the solution of the unemployment problem, and it was to supply the unused land, or to equip and improve under-cultivated land in this particular effort. Large-scale farming had a contribution to make; there were considerable arable areas in which the present system of agriculture had broken down and it was necessary to discover how that land could best continue production before the Government could embark on a policy with regard to it. It was impossible to prophesy how this experiment would go. The Government intended that a public Corporation of chosen men should be set up to run it. As regards small-holdings it was surely better to give work than to give maintenance. The Bill was a genuine attempt to provide work. Since the War, including the immediate post-war settlement, when men often suffering from shell-shock and other causes were settled on the land, and in spite of the last two years of agricultural depression, only 15 per cent. of settlers had failed to make good as small-holders. It was, moreover, the small farm that had been just able to hang on during the last few bad years. It might not be the most efficient form of cultivation, but the small-holding had the power of

lasting. As regards cost, Mr. Donaldson had suggested that 125,000 men would be settled. It was impossible to say how many would be settled. It was not known how many were going to apply and how many of those would be suitable. Common sense would dictate the course to be steered as the business went along, and the Government meant to put its back into the work of settlement. The Ministry believed that, given suitable men and the best equipment, it was possible to make a real contribution not only to the men's own prosperity but to the social and national economy of the country. In the course of a short reply to the debate, *Mr. Donaldson* said that the accounts for the Bill would be debited against the Ministry of Agriculture by the Treasury, and, therefore, it had to be looked upon as an agricultural Bill. The expenditure, however, would, he repeated, be of no benefit to agriculture.

The resolution was put to the Meeting and carried without a count being taken.

The Meeting then adjourned.

* * * * *

APPENDIX I

REPORT FROM THE STANDING COMMITTEE ON THE MARKETING OF HOME-PRODUCED CHEESE

(1) The Standing Committee, in carrying out the work entrusted to it by the Council, to inquire and report with a view to recommendations for improving the marketing of various home-produced commodities, begs leave to present to the Council its Report on the Marketing of Home-Produced Cheese.

(2) In June, 1928, the Committee presented a Report on the Marketing of Milk, and in May of last year two reports were presented on other aspects of the milk industry as they affected the producer. In the Report of June, 1928, the serious factor in the marketing of milk caused by the existence at certain times of the year of large supplies surplus to ordinary market requirements was brought clearly to light. The question of cheese- (and butter-) making is necessarily bound up with this problem of surplus. The milk-producing industry can never regard itself as properly organized for marketing purposes whilst it allows, on the one hand, an abundance of surplus milk to be sold to distributors at a price below the cost of production, thus injuring the ordinary milk market, and, on the other, leaves undeveloped its resources to meet the large home demand for cheese (and butter).

(3) It seems that, in common prudence, a definite minimum quantity of milk should be set aside annually for the making of dairy products, and that means should be found to enable a larger quantity to be so dealt with as it occurs as surplus milk without the organization being overstrained. In other words, it should be arranged by the cheese- and butter-making interests and those of any other sub-industry utilizing milk that they can between them expand their output to the limit of any ordinary surplus of milk and so be able to take the strain from the fresh milk market. This can only be done by organized

producers, acting for the industry as a whole, taking stock of the milk situation and mobilizing their resources in the most efficient manner possible. Obviously, some price adjustment would have to be made for farmers who supply their milk for cheese- (and butter-) making instead of putting it into the retail fresh milk market. This would follow as part of a comprehensive scheme whose main object would be, while using all milk to the best advantage, to get the best price for associated farmers. Under such a scheme, milk producers would, broadly speaking, be paid at the same rate for all milk sold irrespective of the use to which it was put. The weakness of the present unorganized position both from the milk and cheese producers' point of view is illustrated by the fact that during the past 20 years or more, much cheese- (and butter-) making plant, and knowledge, have been scrapped in times of satisfactory fresh milk prices.

(4) The Committee makes this general statement so that the Council may have in mind a true picture of the background of the milk marketing position. Other general arguments in favour of the development and extension of the cheese-making industry in the country are (1) that the best English cheese has a quality and a flavour which are unsurpassed; (2) that there is plenty of home demand for cheese, because, though we produce the best, three-quarters of our requirements are imported; and (3) that the National Mark scheme, which can be applied to cheese, offers an opportunity to the industry which it has never before had, viz., to grade and mark its produce so that it can be sold on its merits and not confused in the mind of the consumer with any variety of imported cheese. This last factor should do much to encourage the production of the best cheese in larger quantities than at present. At present, there is not nearly enough of the best of either of the leading varieties—Cheshire or Cheddar—to satisfy the home demand for the best. Representatives of both industries have informed the Committee that there is never any difficulty in selling admittedly first-class cheeses, though these, we gathered, would not amount to more than about 25 per cent. of the whole supply. We see no reason why this position should be allowed to continue. The cause of so much second and lower quality cheese is that, generally speaking, the industry has not hitherto been organized so as to bring home to the backward individual his technical shortcomings. Some dairy farmers to-day do not yet appreciate what is meant by "bacteriological cleanliness," and how important it is that all milk for cheese-making, as for other uses, should be bacteriologically clean. Indeed, the last item is so important that it operates in practically every case of poor quality cheese. Undesirable bacteria develop in the cheese through being present, as a rule, in the original milk. The Committee has no hesitation in saying, after the most careful inquiry it could make, that the use of clean milk, free from contaminating bacteria, is the chief desideratum in cheese-making. The processes of manufacture must also be guarded against the introduction of infection. After that, good cheese-making is a matter of method. Some differences, mostly in the texture and flavour of the finished product, will always arise through differences in the soil, the pastures, the cows, or their feeding, methods of making cheese, conditions of ripening, etc., and cheese will always be more difficult to make well on some farms than on others, but these differences will not usually prevent the cheese from being of good quality provided it is made from milk which has been produced in a really clean way under clean conditions.

(5) From this statement, it follows that the Committee regards dairy education by teachers acquainted with scientific methods—education of the type which the County Councils, County Agricultural

Committees, and their officers usually offer—can be of enormous assistance in getting into the first class a larger proportion than at present of the cheese produced in this country. It may, in the future, be found good policy to go further and encourage dairy farmers who do not at present make cheese to do so, and so provide themselves with an alternative market to that in which they sell their fresh milk, thus making their industry economically stable and leading to a direct addition to the wealth of the country. The Committee, therefore, has pleasure in paying a tribute to the work which county dairying teachers are at present doing, and urges an extension of the type of education which emphasizes the necessity for clean milk. The holding of Clean Milk Competitions among dairy farmers has been found specially useful in certain counties.

(6) Now to consider the actual question of the marketing of such cheese as is produced. The Report of the Ministry of Agriculture's Markets Division on the "Marketing of Cheese," which was issued only last year, gives a lengthy and thorough survey of the position. It deals with the various types and varieties of cheese made in this country, their supplies and prices, the cheese-making areas, and the development of factory cheese-making. It includes an account of cheese-grading, so far as it is done in this country and in the Dominions and elsewhere, and discusses wholesale marketing, distribution to the retailer, and the question of storage where the cheese is not to be sold immediately. With the general trend of the Ministry's recommendations for improvement the Committee heartily agrees, though it proposes in this Report to restate the case in its own way in summarized form and make its own recommendations.

(7) The annual consumption of cheese in Great Britain is estimated at 186,000 tons, of which less than one-quarter, including both farm and factory-made cheese, is home-produced. Of imported supplies, New Zealand and Canada furnish between 80 and 90 per cent., all factory-made cheese. The leading home-produced varieties are Cheshire and Cheddar, then Lancashire, Caerphilly, Stilton, Leicester, Derby, Wensleydale, and certain others. The quantity of Cheshire cheese produced in this country is stated to be as much or more than all the other cheeses put together. Cheddar is the next largest production, the other varieties coming along with much smaller quantities. The average consumption of cheese per head in Great Britain is estimated at 9½ lb. per annum—a relatively small amount considering the food value, palatability, and cheapness of this food. It is noteworthy that supplies of cheese from New Zealand and Canada dovetail, the bulk of the one coming into the country the first half of the year, that of the other in the second half.

(8) Broadly speaking, cheese may be put into three classes according to the moisture content—i.e., hard-pressed, lightly-pressed, and soft cheese—and usually their length of "useful life" depends upon the same factor; a soft cheese will get mature and go off quickly, a hard-pressed cheese will mature slowly and remain sound a long time. The different kinds will now be dealt with in order of importance in the next succeeding paragraphs.

(9) To take Cheshire first; Cheshire includes three kinds—early ripening, medium-ripening, and late-ripening. The early-ripening cheese is made in the spring and sold for consumption within a month or two. The two other kinds are made later, usually for particular markets according to their special requirements, the North requiring a mild, softer cheese, the South, generally speaking, one which is well-matured. The best cheese, because of the richer quality milk then produced, is made in the autumn, and this is mostly sold and consumed within the next nine months. Stocks of

mature cheese become depleted in the spring, and then, and thereafter, command top prices. Some Cheshire cheese is factory-made, though most of it and the best is made on individual farms and sold to factors or direct to large retail shops. Fairs are held, at intervals of three weeks, in about half a dozen centres and the produce "pitched," which does not always include the best, is sold to factors attending them. A grading scheme under the aegis of the Cheshire Cheese Federation—a producers' association—is in operation and is used at present for about 5 per cent. of the cheese only. This cheese, graded by the Federation's own grader, secures a somewhat higher price than ordinary ungraded cheese, though, through lack of the Federation's strength as a bargaining power, it does not appear always to fetch the full price which its quality justifies. Members of the Federation have the advantage of the expert advice of the grader, and their produce is subject to close scrutiny at almost every stage of its production. This tends to improve the quality still further. In any case, its reliable grading gives it a better standing, and under fair market conditions that alone should mean a better money return for the article.

(10) The bulk of Cheshire cheese, however, is bought ungraded, either direct from the maker's premises or at the fairs. It is usually then transferred to the factor's warehouse where it is conditioned, the factor bearing the loss through diminution in weight and any waste incurred in ripening. He allows for this, no doubt, in the price he pays to the farmer, but his service is one of considerable importance to the industry, and suits the farmer, who has usually no adequate storage for a large quantity of cheese, or, if he has, is not in a position to market it at the right moment of fitness, and in the best market for it, as is the factor. Information as to local market requirements such as colour, texture, and maturity is part of the factor's "stock-in-trade," as is also his ability to judge values in the varieties of cheese he sells. The present division of functions between the maker and the factor—in the Cheshire cheese-making industry at any rate—seems to work fairly well.

If, however, Cheshire cheese producers, or those of any other variety, decide to combine to a greater degree than at present, their organization might usefully take over a somewhat larger part of the work than they do now. In the case of the Cheshire producers, they might not only guarantee members' cheeses as being made from full cream milk of the highest quality, but store cheese in the earlier stages, and grade it at the point where they sell it to the factor. This suggestion represents an advance beyond the Ministry's grading proposal, which is that the cheese should be sold, when new, to the factors, who should be empowered, in the absence of any suitable organization on the producers' side, to carry out the grading.

In addition, they could, with the help of the factors' organization, carry out general publicity work for popularizing Cheshire cheese, both in this country and abroad. An alternative to co-operative action on these lines would be for the producers' organizations to come to an arrangement with existing factors to sell their cheese for them on commission, as is done in a few instances in Cheshire already. On the whole, however, we are not disposed to recommend this as a sound course of action. It would be liable not to get the best value for the Cheshire cheese industry out of the selling activities of the factors.

(11) What we would recommend for improving the marketing of Cheshire cheese, then, is combination of producers, the storage of their cheese up to the point of grading and sale thereafter to factors, both producers and factors joining together for the purpose of efficient advertising and supplying the larger market thus produced

(12) An abuse of fair trading, which we are informed goes on to some extent in the retail markets in which Cheshire cheese is sold, especially during the winter, is the sale of half-meat Dutch cheese as Cheshire. Notwithstanding precautions which are taken by Dutch exporters to mark this product clearly as half-meat cheese, it is said to be sometimes sold as Cheshire. These deceptions, of course, must be stopped. The existing law is against them, but apparently cannot be relied upon to be carried out in the face of great determination on the part of any one of the distributors to misrepresent the goods. It is suggested that one effective way to help the law in this respect is by applying the National Mark to all standard home-produced Cheshire, and urging all shoppers to insist on seeing the Mark on the actual cheese from which they have seen their purchase cut.

(13) As regards Cheddar cheese, the marketing position is much the same as with Cheshire, and the general comments made in regard to that variety apply to it as well. September Canadian Cheddar is also said to be sold all over the country as English, when the market for best Cheddar is ill-supplied. The law against which this is a direct offence should be more rigidly enforced. There is a producers' grading federation, known as the English Cheddar Cheese-makers' Federation, which, however, has been less successful so far, even, than that in Cheshire. The cheese-factors play a similar part in the sale of this usually longer ripening commodity, which requires, on the whole, as much and sometimes even greater care and skill than does Cheshire in its proper storage and conditioning. As the making of Cheddar can be more easily reduced to rules than that of any other chief variety, it is called upon to withstand greater competition from overseas. It is the variety mainly imported. But there is never any difficulty in selling the best home Cheddar, and the aim of Cheddar cheese producers, therefore, is to grade up their output so as to place more of it at the top of the market. There is always room for the best, and the price is invariably good. Here, again, co-operation of producers, followed by a grading scheme in the hands of associated producers after storage and ripening in their own storehouse, are recommended to give the best return to the producer. The cheese-factor should play a very important part at the selling end of any such improved organization of producers.

(14) We have dealt at some length with the Cheshire and Cheddar cheese industry, and will pass the others over with a few brief words indicating any special features. It may be said that they all appear to require the same kind of effort by the producers themselves to make their marketing more successful. *Stilton* is made in two varieties—the white (or "green") kind early in the year mainly for the Midland and Northern market, and the matured kind, i.e., the best-known *Stilton*, for the end-of-the-year market. The industry is one which is full of possibilities. Its cheeses are the most prized and valued of any in this country—perhaps in the world.

There is already a fair measure of co-operation amongst the Leicestershire and district producers of it, but they sell direct to wholesalers and in competition with each other, group with group. That position cries aloud for remedy. Then there is an insufficient market for the early white *Stilton*, which we are informed can be sold retail at about 1s. per lb. at present, as against the price of 2s. and more for matured *Stilton*. *Derby*, *Leicester*, and *Gloucester* are the names of three other cheeses—all hard-pressed—which are mostly only locally known. *Caerphilly* is small uncoloured cheese, with a soft, springy texture and a mild flavour. It is a favourite in South Wales, and is made largely in Somerset. It is easy of manufacture and can be made throughout the year. It is, moreover, economical in that

there is a high yield of cheese in it to milk used— $1\frac{1}{2}$ lb. to 1 gallon of milk—and being a lightly-pressed cheese which needs no storage to make it mature, it is sold at once with a minimum of trouble and anxiety to the maker. It also turns the farmer's money over quickly for him. There are weekly auctions of Caerphilly at Highbridge in Somerset, and the prices given there govern those paid on the farms. *Wensleydale* is like *Stilton* in most respects, though it is lightly pressed and is banded during ripening. Another variety, comparable with "White *Stilton*," is usually consumed in a fairly fresh condition at about six or eight weeks old. *Lancashire* cheese is similar to *Cheshire*, but coarser in texture and famed for being the best toasting cheese, melting down into a smooth substance of rich and appetizing appearance. *Dorset Blue* is a special variety of skimmed milk cheese, which is prized for its flavour when the cheese is fully ripe; at present, it appears to have no more than a local appeal. The *Cambridge* (or *York*) cheese made in the Isle of Ely is a soft cheese sold in flat layers of about 1 lb. weight for consumption within a few days of manufacture. *Colwick* is a similar cheese made in parts of the counties of Nottingham and Leicestershire, while *Cream* cheese is made all over the country for consumption within from two to ten days of making.

(15) In addition to this list, there may be other varieties of local manufacture, and there are the "processed" cheeses which are made of ordinary cheeses, ground up and emulsified, of the varieties which lend them their names. These latter are moulded in tin foil wrapping whilst hot and fluid and are sold in their tin foil segments in small boxes. They are much in demand, though they cannot be said to compare in food value for money with any of the ordinary brands of English bulk cheese. They are simply useful in taking off the market the bulk cheese used in their manufacture.

(16) Despite the fact that the best *Cheshire* and *Cheddar* cheeses are made on individual farms, there is a growing movement in favour of cheese-making in factories, or, what is sometimes much the same thing, in a central farm which specializes in cheese-making and is supplied by neighbours with milk on contract. The commonly accepted reason why factory cheese is not up to the good standard of farm cheese is that it is made of mixed milkings, some good, some poor, some old, some new. If that is true, the remedy is not far to seek. Better business methods, including payment to the farmer for quality of milk on a butter-fat basis, should completely alter the outlook. It is unfair that the present usual method of payment by factories for milk should continue—no more being paid for one kind than for another. But such anomalies would, it is opined, quickly disappear when milk and cheese producers get together to work out sound schemes of making and marketing their product. The need to do this is seen to be urgent when cheese producers are reminded that the percentage of their total output which is of superlative quality is not great, and that the remainder has to compete with well-made, well-graded, full-milk factory cheese from overseas. No cheese of less than 50 per cent. fat in the moisture-free substance of cheese is allowed to be exported from New Zealand or Australia, whilst the minimum for Canadian exported cheese is 45 per cent. It is calculated that to give a 50 per cent. fat in cheese a $3\frac{1}{4}$ per cent. of butter-fat in milk is required, so that farmers will see that there is no margin for skimming any cream off their cheese-milk. Indeed, it is most important in nearly all varieties that full-cream milk should be used, and we would suggest that a guarantee that it is used forms the basis of any properly regulated grading scheme. In New Zealand, payment for milk at the cheese factory on a butter-fat basis has had the effect of raising the

percentage of butter-fat in the raw material so that the fat content of the cheese made from such milk is higher than the market requires. The factories there are allowed to adjust the matter by withdrawing some fat to bring exceptional milk down to average. We do not recommend any such action in this country. Here, uniformity is not so much required as it is in the case of imported brands. It is high quality that is needed. The case for special prices for the best home cheeses depends upon their individual merits, and they may, and should, vary—but they should fall within the prescribed grade qualities, and their contents, so far as butter-fat is concerned, should be guaranteed. Under the present order of things, English Cheddar and Cheshire easily lead the market, sometimes by 30s. and more per cwt., so that the quality is there and is recognised. What is wanted in the interests of the industry is more of the best cheese.

(17) Taking a general view of the whole industry, it appears, in the first place, that there is a compelling need for securing development of cheese-making of all the varieties which have become established in this country. The more home-produced cheese that can be made and marketed, the less will the milk industry be threatened with surplus milk and the more the country will be contributing to its own food supply. Cheese is a very good all-round food, and taken in a varied diet is palatable and satisfying. The steps most immediately required are the organization of producers of each considerable variety of cheese for (1) all-round better methods of production, and (2) all-round improved methods of marketing. As to the best means of obtaining (2), the immediate institution of a National Mark scheme for cheese, each variety being graded according to a plan agreed with each group of producers and distributors, appears to be the best procedure. The grading of the cheeses should be done by experts towards the end of the storage period. A casein disc, as recommended in the Ministry of Agriculture's scheme, should be placed in the rind of each cheese on its manufacture, and this should guarantee that the cheese is made of whole-milk. Where a cheese develops badly in store, or does not ripen properly, and is, therefore, unfit for the Mark, the casein disc, which has become worthless from the point of view of the scheme, should be over stamped so as not to mislead persons uninformed of the details of the scheme into thinking that the disc gives any other guarantee than that the cheese was made of whole milk.

(18) We would suggest that steps be taken, in the first place, with two or three varieties only, possibly, Cheshire, Cheddar, and Stilton. The facilities proposed under the Agricultural Marketing Bill now before Parliament should assist producers to organize on the lines suggested.

(19) When formed for this purpose, 'producers' associations or boards would no doubt make it one of their earliest duties to ascertain what the large market in the big industrial towns really wants from them; whether it is a large cheese, or one just large enough to see the average small grocer through his usual week-end custom without the need for much "refacing" of the cheese and cutting to waste. In this connexion, it has been put to us by a prominent member of the retailing business that the best weight for an English Cheddar or Cheshire is from 50 to 60 lb. Most are now made at 80 lb. or upwards; that is a good weight for imported cheese which, being cheaper, usually sells quicker. What the larger distributors want is to be in a position to buy 100, 200, or 500 Cheddar cheeses, all of similar sizes and stated qualities. This they could do from the storage depots of organized producers in the same way as the cheese-factor would buy from such

depots. The number of shops now selling English Cheshire or Cheddar is comparatively small, and there is a large market awaiting keen business endeavour as soon as a National Mark scheme is set on foot, and gives its guarantee to the retailer and the public.

(20) For convenience of reference, the main conclusions of the Committee are summarized as follows:—

- (a) That the dairy industry should become fully organized so that the cheese section of it can be supplied with milk at a fair price to enable it profitably to make cheese of the various kinds for which a market exists.
- (b) That each group of cheese-makers should concentrate on making the best quality cheese of its particular variety, and that for this purpose special attention should be paid to the production of milk which is bacteriologically clean.
- (c) That to assist in (b), the County Authorities should extend their scientific dairy education in the Counties and the holding of Clean Milk Competitions.
- (d) That cheese producers' associations in the case of those varieties requiring storage and selected for marking with the National Mark should retain their cheese in their own stores until it approaches maturity, when it can be marked with the National Mark. At this point, the factors would normally take control of the selling and do whatever is possible to improve the marketing.
- (e) In order to prevent mistakes and fraud, purchasers of cheese should, in buying home-produced, or (later) National Mark cheese, see that the cheese they buy is cut from the block or round of cheese marked with the corresponding label. The law prohibiting the sale of imported Cheddar, or Cheshire, or any other place-named variety of British cheese without a label indicating that it is imported Cheshire, Cheddar, etc., should be more strictly enforced.
- (f) That in view of the desirability of assisting the sale of early white Stilton (locally called "green"), the fact that it may be purchased in the early summer at about 1s. a lb. retail should be widely advertised.
- (g) That the public be advised that, as a rule, the quality of cheese depends upon fat content, which, again, depends upon the butter-fat in the milk used. Much imported cheese is poorer in fat content than home-produced, and if the National Mark scheme proposed by the Ministry of Agriculture is adopted in its present main features, National Mark Graded cheese will be the certain product of this country and will be made only from Whole Milk.

February 2, 1931.

APPENDIX II

REPORT FROM THE STANDING COMMITTEE ON THE QUESTION OF PROSECUTIONS UNDER THE FERTILIZERS AND FEEDING STUFFS ACT, 1926

(1) The question of the effectiveness of the requirements of the Fertilizers and Feeding Stuffs Act, 1926, in regard to the institution of proceedings against merchants who supply farmers with feeding stuffs which are not up to the guarantee was raised in a resolution at the last Meeting of the Council. The suggestion in the resolution

was that the present provisions of the law, whereby action in the Civil Courts is prescribed, should be replaced by power to Local Authorities to institute criminal proceedings in respect of defective samples taken on the premises of the purchaser. The resolution was not carried, the voting for and against being equal. The Standing Committee, on that result, considered that, in view of the body of opinion on the Council in favour of a reversal of the form of the law, there must exist, either apprehensions which are justified and should be met by changes in legislation, or misapprehensions which should be cleared away. It, therefore, examined the whole question as far as it was able, and now presents the following Report.

(2) It appears that one of the chief conclusions of the Departmental Committee on Fertilizers and Feeding Stuffs Legislation, which reported in 1924, was that criminal proceedings should no longer be instituted in respect of samples taken on the farm, but only in respect of samples taken on the premises of the seller. The object was not only to remove any risk of unfairness to the trader but to meet the farmer's objection to being drawn into criminal proceedings in respect of samples taken on his farm. It was thought by that Committee that the farmer's objection in this connexion had the effect of making the legislation less effective than it should be for its purpose. That Committee were unanimous in their view that there should in future be no prosecutions, but only civil proceedings, in respect of samples taken on the farm.

(3) The position then is that where a sample taken on a farm proves to be unsatisfactory, the seller cannot be prosecuted in respect of that sample, although the purchaser can claim for damages—in the Civil Courts if necessary—after the proper marshalling of his evidence, which should include a certificate of analysis by the Local Authority's officer appointed to issue such. It is, however, practicable for the officer of the Local Authority, finding an unsatisfactory sample on a farm, to communicate with the inspector for the district from which the goods came, and so enable a prosecution to be taken in hand by drawing a similar sample on the premises of the really responsible party. This procedure represents an advance on that of the earlier Fertilizers and Feeding Stuffs Act (of 1906) in which it was frequently found that the man whom the law required should be prosecuted was an intermediate seller who was not morally responsible for the misdescription.

(4) It has been represented that the new provisions fail in effectiveness because of the need for Local Authority inspectors to trace a given parcel of goods from the farm through two or three, or more, middlemen to the manufacturer, who, by the time the last inspector arrives at his factory, has no more of the article in question and cannot, therefore, contribute the evidence on which he could be prosecuted. It is stated also that because of the form of the law—the onus for action in the case of "farm" samples resting with the purchaser who must get redress by civil means—no action is taken; the purchaser does not care to take the trouble.

(5) The Committee has considered the whole position, and has come to the conclusion that, as suggested by Sir Charles Howell Thomas at the last Meeting of the Council of Agriculture, the Act of 1926 should be given a further trial. In the first place, criminal proceedings do not depend on samples being first taken on the farm. There are a number of Local Authorities which are regularly sampling on the premises of sellers, as a matter of routine, in order to test the accuracy of the descriptions applied to the goods sent out. In the second place, the fact that comparatively few proceedings, either civil from samples taken on the farm, or criminal from samples taken

on the manufacturer's premises, have been instituted, may largely be due to an insufficient realization of the true position by farmers and their advisers, though doubtless many civil cases are settled out of Court. If, however, farmers would exercise their right under the Act to call upon the Local Authorities' officers more frequently to take samples and have them analysed officially as laid down in the Act, then the farmer would be more frequently put in a position to claim for any shortage from the manufacturer. Local Authorities charge, usually, a very small fee for this service, which covers the taking of samples of ordinary fertilizers or of concentrated feeding stuffs and analysing them. On the showing of the certificate which the farmer obtains, he can base his claim on the manufacturer, or the person responsible for stating the analysis which is proved to be wrong.

(6) It does not seem to the Committee that the farmer need fear to incur odium, or disadvantage of any kind, through standing up for his rights as a buyer, on production of clear evidence of error on the part of the supplier. It is always understood that in serious cases the Local Authorities' inspectors can make a point of discovering and prosecuting a fraudulent manufacturer or merchant, but in ordinary instances where the shortage may be due to minor discrepancies which the manufacturer or merchant would quickly put right if he knew about them, it seems that a straight and simple request from the farmer for reimbursement, backed by the Local Authority's certificate, is the best way to meet such cases. There seems to us no question that if farmers widely use the provisions of the Act of 1926, suppliers would become very careful to see that their goods came up to sample before sending them out.

(7) We, therefore, recommend that the fullest possible publicity be given to the provisions of the existing laws, and the measure of protection which they give to farmers, and that farmers be recommended widely to use them.

January 22, 1931.

MARCH ON THE FARM

WILLIAM LAWSON, M.B.E., N.D.A., N.D.D.,

Director of Agriculture for West Sussex.

Arable Land.—An early decision must be made as to what crops, if any, are to be grown on the fallow or root area. It is possible that the area under sugar beet may be somewhat reduced, though we must hope not; there is great difficulty in deciding which crop should take its place. Sugar beet has the merit of being at the same time a cleaning crop, a source of food for live stock and a direct cash crop. No other crop can take its place in all these particulars.

Potatoes are a cash crop, but in years of heavy yields the producers may be faced with low prices. Most of the other crops suited to the fallow year of the rotation have to be cashed through live stock, and their value is difficult to assess. The actual cost of growing the fallow crop cannot be accurately determined. On a strict economic basis the costs are considerable, but a very large amount of the expenditure included is on account of work done by the regular staff of whole-time farm workers and horse teams or tractors. Much of this expenditure may be unavoidable in any case, and if the fallow crop is eliminated we must inquire whether the horse teams and men can be employed on other work, and would that other work be remunerative. Farmers must answer these questions for themselves, having regard to their individual circumstances, and then assess the cost of the fallow crop. The other side of the account is the value of the fallow crop to the stock farmer, and particularly the large amount of stock food which can be produced per acre.

There is a great variety of crops to select from, and each crop has its individual varieties and strains. Most varieties are well suited to our climate, and there are few countries where root crops can be grown to greater advantage. Crops of one or more types may be grown according to circumstances. Mangolds are a great favourite in the south and Midlands, but, farther north, swedes and turnips are predominant. Green crops like cabbages, marrow-stem kale, thousand-headed kale, rape and rape kale are increasing, and are valuable sources of green food available during winter when the need is great. The value of green food in winter is being increasingly appreciated, as the needs of the animals are better understood.

As long as there is arable land, and as long as live stock

are a feature of farming, the growing of green crops and roots for winter consumption has attractions and advantages. It is not inconceivable that in many cases arable land will be maintained to produce such crops, as well as straw, irrespective of the price of grain.

The nature of the soil will determine the extent and the nature of the fallow crop. On heavy soils the bare fallow is still the cheapest and best method of cleaning the land. On the lighter soils some form of cropping is desirable. In typically arable districts working on a four- or five-year rotation the fallow area is greater than is desirable or economical at the present time.

A reduction of the fallow cropping may be effected in several ways. Silage crops are a useful substitute, and a mixture of 40 lb. tares, 40 lb. beans and 80 lb. oats, sown in early spring, will provide a crop for silage in July, or a similar mixture substituting peas for beans can be cut at the same time and made into hay; in either case the crop is removed in time to allow fallowing and cleaning to be done in preparation for winter cereals.

Temporary Pastures.—The adoption of longer rotations and the inclusion of temporary pastures for three or four years is an obvious way of reducing the fallow area. Such a practice means a reduction in cereal cropping and an increase in live stock farming. Temporary pastures have long been a feature of Scottish farming, and though much less common in England, particularly on the eastern side, it seems inevitable that the practice will increase.

The engineer has put at the disposal of the cereal growers in all parts of the world machinery which is specially adapted for large-scale cultivation of cereal crops, and the small cultivator, whose turnover is insufficient to justify the capital expenditure involved, is at a disadvantage. Large farms highly mechanized are dominating cereal production.

In face of these opinions it might be asked why not advise going the whole way and laying the land down to permanent grass? Such a course has its disadvantages. In the first place, live stock require litter to keep them comfortable and clean, and nothing is more attractive to the animal lover in this respect than straw, and there is also the value of the straw in soaking up liquid manure and adding to the value of the farmyard manure. Then there is the question of the winter keep; an all-grass farm produces grass and hay. Grass may be available in good condition for five months

in the year ; with good management this may be extended to six months, and in special circumstances may even be useful for seven months, but that is about the limit as far as cattle for milk or beef production are concerned. This leaves a substantial portion of the year to be provided for without green succulent foods. Root crops or winter greens cultivated on arable land add to the stock-carrying capacity of the farm, and to the health and well-being of the stock. Temporary pastures have a further advantage in responding more readily to manurial treatment and in starting into growth earlier than old-established pastures under the same climatic conditions. This earlier growth is an advantage in years of drought, and the production up to midsummer, at any rate, is usually assured after the winter rainfall.

Another advantage of temporary pastures over permanent grass is the opportunity which occurs for utilizing the fertility which accumulates during the life of the pasture, particularly under grazing conditions. In Scotland the introduction of wild white clover seed into the mixtures for short-term pastures has created a new problem, and one of the needs of the moment is a cereal which can be grown immediately after the temporary ley and will not lodge before harvest.

The extension of temporary pastures can be recommended at the present time because of the relative economic position of stock farming as compared with cereal growing, and also because the knowledge and material now available to make them a success are greater than at any other time in the history of agriculture. Wild white clover and leafy strains of grasses will, with correct manurial treatment, overcome many of the drawbacks to temporary pastures that have been experienced in the past.

Warble Fly.—The campaign for the destruction of warbles carried out in Worcestershire in 1928 and 1929, and over a large part of the country in 1930, should leave no doubt in the minds of stock owners as to the efficacy of the means taken to reduce the pest. The loss due to the ravages of the warble fly is very heavy. The loss of milk, meat and thriving condition caused by the running of cattle when the fly is on the wing must be added to the loss through damaged hide and flesh when the animal is slaughtered. The derris-soap wash is generally recommended and treatment should commence before the end of this month.

Full information can be obtained by consulting the reports of the Worcestershire County Council Agricultural Education

Sub-Committee on the Ox Warble Fly, the Report on the Warble Fly Campaign of 1930 issued by the Leathersellers' Company, or a leaflet on The Warble Fly (No. 21) to be obtained gratis on application to the Ministry.

* * * * *

NOTES ON MANURES

H. V. GARNER, M.A., B.Sc.,
Rothamsted Experimental Station.

Bracken Litter.—Inquiries are sometimes received with regard to the relative values of farmyard manure made from bracken as compared with straw. As far as direct experiments are concerned there seems to be very little information available, but some approach to the question can be made on general grounds. The value of a material for litter will depend on three chief factors :—

- (1) Its absorptive power for liquids ;
- (2) Its retentive power for ammonia ; and
- (3) Its manurial value reckoned on its content of nitrogen, phosphoric acid and potash.

As far as the first item is concerned dry bracken appears to fall below straw, as might be expected from the nature of the material. French figures give the following absorption of liquids per 100 lb. of dry substance :—

Wheat straw, 220 ; bracken, 145, while German figures are more favourable and give rye straw, 240–265 ; bracken, 259. Naturally a good deal of variation is to be expected in such estimates.

Bracken is also probably inferior to straw in its retentive power for ammonia, because, as it is more woody, there is less easily decomposable carbohydrate to balance the nitrogen, while its own nitrogen content is higher to start with—i.e., the material is more nearly saturated in respect of nitrogen in any case.

The content of nutrients in the dry matter of plants varies considerably with the state of growth and the degree of washing to which the plant substance has been subjected. Material cut young and dried under cover will be the richest in plant nutrients. Old fibrous material cut and allowed to stand in the open will be the poorest. This is well shown in certain figures from the West of Scotland Agricultural College :—

<i>Date of cutting</i>	<i>Dry matter</i> (Per cent.)	<i>Potash in dry matter</i> (Per cent.)
May ..	8.0	5.26
July ..	21.5	3.02
October ..	73.9	.77

Bracken is about equal to straw in its phosphoric acid content, but distinctly superior both in nitrogen and potash, although if it is taken when old and much washed the potash may be reduced to about the proportions present in straw. Approximately 95 per cent. of the total potash in bracken is extractable by water.

Some typical analyses are :—

				<i>Nitrogen</i>	<i>Phosphoric acid</i>	<i>Potash</i>
Bracken	..	..	..	2.5-3	.3	2.3
"	..	..	..	2.4	.45	1.86
"	..	..	..	1.44	.20	.11
Average straw	..	..	..	.55	.22	.99

Manure made with old woody bracken takes a long time to decay in the soil, and hence is probably more suitable for use on compact soils, where the fibre may have physical value, than for the more open types of land.

Interactions of Fertilizers.—There are two types of fertilizer experiments. The most straightforward are those in which comparison is simply made between several alternative forms of the same nutrient. For example, nitrate of soda is compared with sulphate of ammonia and with cyanamide, the manures being used alone or in conjunction with a basal dressing common to all the plots. The comparison of several different rates of application of a fertilizer falls into the same class ; as do also variety trials as ordinarily conducted.

More recently attention has been turned to what is called the interaction of fertilizers. This can be investigated by using the manures not only singly but also in combination. Let us suppose, for example, that plots are put down as follows : (1) No manure, (2) nitrogen only, (3) phosphate only, (4) nitrogen and phosphate together. The effect of nitrogen only can be derived from (1) and (2), of phosphate only from (1) and (3) while the effect of nitrogen and phosphate in combination comes from (1) and (4). If, within the error of the experiment, this last effect is the sum of the two individual effects previously mentioned then there has been no interaction (or at any rate the experiment in question has not been accurate enough to detect it), and we may say that nitrogen has produced the same effect at both levels of phosphate nutrition, and phosphate has produced the same increase at both levels of nitrogen nutrition. Moreover, if this is so, the basis for gauging the effects of nitrogen and phosphate in this experiment has thereby been doubled, for instead of having to regard

the phosphate individually we may use (1) and (3) against (2) and (4) to measure the nitrogen effect, and (1) and (2) against (3) and (4) to measure the phosphate effect. The number of plots in the comparison is doubled and the precision of the comparison is increased in the proportion of $1 : \sqrt{2}$ or 1.4 times.

Now quite frequently a definite interaction is revealed in the sense that the combined effect is not the sum of the single constituent effects. It is usually greater ; which means that, as commonly expressed, each fertilizer helps the other out. It sometimes happens that the addition of one fertilizer to another gives significantly less than the effect which might be inferred from their individual action. In any case these interactions when definitely established are real effects which have their bearing on the use of fertilizers in combination, and must be as far as possible interpreted. Further, the arrangement of experiments in such a form as to reveal interactions has the valuable feature that, if an interaction is found, a useful piece of information has been secured, but if no such effect is demonstrated, then the accuracy of the experiment on the other comparisons is increased.

Another common type of interaction occurs when different forms of the same nutrient are used. Thus nitrate of soda and sulphate of ammonia might each be compared in the presence and absence of potash.

(1) Nitrate only, (2) nitrate and potash, (3) sulphate only, (4) sulphate and potash. In such a case it might well be found that the potash effect as measured by (1) and (2) is less than as measured by (3) and (4), when an interaction has occurred and would be expressed by practical men by saying that potash is more necessary when sulphate of ammonia is used than when the form of nitrogen is nitrate of soda.

Clearly the number and variety of interactions is very great. Various interactions with fertilizers have already been demonstrated at Rothamsted in the sense that one variety responds differently from another to the same manurial treatment. Since the magnitude of interactions is usually less than the straightforward manurial effects, experiments of a rather precise nature are necessary to demonstrate them with certainty.

Distribution of Fertilizers.—Much attention is now being devoted to the question of the accurate distribution of fertilizers. This has always been important, but with the definite tendency

towards more concentrated materials which is now making itself felt, and will no doubt continue to be more marked as time goes on, the need for accurate application is still greater. Thus a good grade, complete mixture, made from ordinary constituents, would contain about 5 per cent. of nitrogen, 8 per cent. of phosphoric acid, and 12 per cent. of potash, and the rate of application of such a mixture might vary from 4 cwt. for cereals up to 12 cwt. for potatoes. If the newer high-grade materials of the type now widely used on the Continent were employed to provide the same nutrients as the above, dressings of rather less than one-half of the above would be required. With the smaller dressings there is the possibility of irregular sowing leading to some areas being completely missed, or almost harmful concentrations being applied to others.

Further, there is already the need for the uniform application of small dressings of 1 cwt. of nitrogenous fertilizer to cereals and to grass land, and if more concentrated forms of nitrogen are introduced the claims made on the accuracy of manure distributors will be greater still. Fertilizer distribution on a farm scale is by no means a simple problem. The variation of fertilizers in physical condition is considerable, ranging from distinctly sticky mixtures on the one hand to free-running crystalline powders on the other. Their rate of application may vary from 1 cwt. up to almost 20 cwt. per acre, and uniform distribution is highly desirable. Yet to achieve this it is necessary to have a mechanism which will also stand up to farm usage and work on rough ground. In view of these heavy demands it is not surprising that, in searching tests of fertilizer distributors recently carried out, all the desired points were not discovered in the same machine.

In February, 1930, a trial and demonstration of manure distributors took place at Wye College, when seven different machines representing most of the types in common use were tested. The machines were required to operate as follows :—

- (1) On ploughed land to sow a mixture of 4 parts superphosphate, 1 part muriate of potash and 1 part sulphate of ammonia, at the rate of 6 cwt. per acre—this representing a farm-made mixture of slightly sticky character.
- (2) On seeds ley to sow 4 cwt. superphosphate, 1 part muriate of potash and 1 part steamed bone flour at 6 cwt. per acre—this being a dry friable mixture.
- (3) On grass to distribute cyanamide at 1 cwt. per acre. Photographic records of the spread of the manure on a white surface were obtained for each machine in this test.

As might be expected with so wide a range of designs and working conditions, much information with regard to the

capabilities and limitations of the various types was obtained. These are discussed in a report.*

In April an exhaustive trial of twelve different machines was made at the Experimental Farm of Imperial Chemical Industries at Jealott's Hill (see this JOURNAL, August, 1930, p. 439). The machines were required to apply the following dressings:—

- (1) North African phosphate, 6 cwt. per acre.
- (2) Complete mixtures, ordinary grade, 3 cwt. per acre.
- (3) High-grade mixture, 2 cwt. per acre.
- (4) Sulphate of ammonia, 1 cwt. per acre.

A quantitative measure of the distribution along the track of each machine was obtained by weighing the manure caught in a series of trays laid in the line of travel, while the lateral distribution was judged by inspection of exposed surfaces suitably coloured to show up the manure. These patterns were also photographed. Many numerical data were obtained with regard to the capabilities of various classes of machines in handling the above manures, and also on the important question of adjustment to deliver stated quantities.

All this work is to the good and cannot fail to direct the attention of manufacturers to certain points capable of improvements.

Similar work is being vigorously undertaken in the United States, with a view to economy in the use of fertilizers by the better results following correct and accurate methods of application. The special interest there lies in the correct location of the fertilizer salts in relation to the seed of crops grown in wide drills, maize, cotton, and potatoes, the object being to secure the advantage of a high concentration of nutrients in the neighbourhood of the growing plant while avoiding the risk of injury to germination. As in this country, detailed examination of the performance of existing machines has revealed many points in which improvements should be possible.

Although the time of application of manures is receiving some attention in this country, the position of fertilizers in relation to the rows of potatoes, sugar beet and other root crops has not as yet been closely investigated.

* C. Davies and G. R. B. Smyth: *Demonstrations and Trials of Manure Distributors*, Wye College, 1930.

PRICES OF ARTIFICIAL MANURES

Description	Average prices per ton during week ended February 11				
	Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) ..	10 0d	10 0d	10 0d	10 0d	12 11
Nitro-chalk (N. 15½%) ..	9 7d	9 7d	9 7d	9 7d	12 1
Sulphate of ammonia :—					
Neutral (N. 20·6%) ..	9 10d	9 10d	9 10d	9 10d	9 3
Calcium cyanamide (N. 20·6%) ..	8 16s	8 16s	8 16s	8 16s	8 7
Kainit (Pot. 14%) ..	3 8a	2 19a	2 19a	3 3a	4 6
Potash salts (Pot. 30%) ..	5 6a	4 18a	5 0a	4 19a	3 4
" (Pot. 20%) ..	3 17a	3 9a	3 8a	3 12a	3 7
Muriate of potash (Pot. 50%) ..	9 17a	9 3a	9 2a	9 5a	3 8
Sulphate, " (Pot. 48%) ..	11 19a	11 6a	11 5a	11 5	4 8
Basic Slag (P.A. 15½%)|| ..	2 13c	2 3c	..	2 9c	3 1
" (P.A. 14%)|| ..	2 7c	1 16c	1 16c	2 3c	3 2
" (P.A. 11%)|| ..	..	1 9c	1 9c	..	..
Ground rock phosphate (P.A. 26·27½%)|| ..	2 10a	..	2 9a	2 7a	1 9
Superphosphate (S.P.A. 16%) ..	3 11	..	3 9	3 1	3 10
" (S.P.A. 13½%) ..	3 5	2 18	3 3	2 15	4 0
Bone meal (N. 3¼%, P.A. 20½%) ..	8 15	7 10	8 2	6 10	..
Steamed bone flour (N. ¼%, P.A. 27¼-29¼%) ..	5 19b	5 5f	5 15	4 7	..
Burnt Lump Lime ..	1 5l	1 2m	1 9	1 17h	..
Ground Lime ..	1 12l	1 8m	..	1 12h	..
" Limestone ..	1 3l	1 6g	1 7k	..	..
" Chalk ..	..	1 6g	..	1 11h	..
Slaked Lime ..	..	..	2 9	2 17h	..

Abbreviations: N.—Nitrogen; P.A.—Phosphoric Acid; S.P.A.—Soluble Phosphoric Acid; Pot.—Potash.

* Prices are for not less than 6-ton lots, for delivery during the month, at purchaser's nearest railway station, unless otherwise stated. Unit values are calculated on carriage paid price.

† Prices are for not less than 2-ton lots, net cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. price.

|| Fineness 86%, through standard sieve.

a Prices for 4-ton lots f.o.r.

b Delivered (within a limited area) at purchaser's nearest railway station.

c Prices for 6-ton lots; at Bristol, f.o.r. Bridgwater; at Hull and Liverpool, f.o.r. neighbouring works, and at London f.o.r. depots in London district.

d For lots of 4 tons and under 6 tons the price is 1s. per ton extra and for lots of 2 tons and under 4 tons 6s. per ton extra.

e Delivered in 4-ton lots at purchaser's nearest railway station.

f Delivered Yorkshire stations.

g F.o.r. Knottingley. Ground limestone 100% through standard sieve.

h Carriage paid 6-ton lots London, bags included.

i In bags, f.o.r. Liverpool. Fineness 45% through standard sieve.

! Carriage paid 6-ton lots Bristol.

m Carriage paid 6-ton lots Knottingley.

NOTES ON FEEDING STUFFS

H. G. SANDERS, M.A., Ph.D.,

School of Agriculture, Cambridge.

Specific Action of Foods.—The nutritive value of a food is measured by its starch equivalent and digestible protein content; several other properties are recognized, such as its content of minerals and vitamins, and its effect on the rate of digestion, but even with all these it is sometimes felt that we do not take cognizance of all aspects of the food. One very difficult question is that of its specific action for any particular function in the animal body. The point can be made clear by reference to a case quoted to the writer by a correspondent in India who is responsible for the feeding and management of large numbers of cows. One food that he has available is a pea called gram, and he finds that this shows a marked superiority to other foods, such as a mixture of barley and linseed cake; that is to say, an amount of starch equivalent and digestible protein in gram produces better yields than the same amount in other foods. The explanation of this may lie in some vitamin-like substance occurring in small quantities in the gram, but more probably, as the correspondent suggests, in the composition of the protein. It may be that some amino-acid, which is apt to be deficient, figures largely in the protein of gram, and consequently that this food, as it were, pulls more than its own weight; this view is strengthened by the fact that a wider nutritive ratio can be allowed when the ration includes gram than when it does not.

The general experience is that protein has a stimulating effect. It is known to increase the heat production of the animal, and this is referred to as the "specific dynamic action"; all foods exert some influence in this direction, but proteins far outstrip the others. The actual increase of heat production can have little agricultural interest, but it seems to be associated with a raising of the whole metabolism and consequently with an increased production. Several experiments have led to the conclusion that feeding protein well above the requirement to milking cows gives an increased yield, and, in some cases, that the fat percentage is also raised; increasing the starchy and oily foods, on the other hand, has not had the same effect. Nevertheless, some experiments have gone the other way, and, in view of the contradictions that have appeared in trials, it could not be recommended to overfeed in the expensive part of the ration (protein) with the idea of stimulat-

ing yield ; any extra production caused in this way involves inefficiency in the conversion of the food to milk, and would be uneconomic. The contradictions have probably arisen because proteins have different " qualities "—that is, some have a composition suitable for providing the materials for building up milk proteins whilst others have not. It would, therefore, be better to try to use the proteins of high quality than to overfeed indiscriminately ; here, however, there is little information available for guidance.

In general, the proteins of clover hay, bran and linseed cake are good, whilst those of milk and its products are regarded as perfect. At the other extreme the protein of maize is bad, since it is incomplete and lacking in essential amino-acids, whilst oats, middlings, and cotton-seed are intermediate between the good and bad. Presumably a protein may be good for one purpose though bad for another, but as yet we know few details on this. Barley is good for maintenance and fattening, but bad for growth, and possibly also for milk production ; brewer's grains are good for milk, but bad for growth. With milking cows it has been shown that the proteins of wheat are not efficient, and that if the milk yield is at all considerable (3-4 gal. a day) the protein balance cannot be maintained on them ; the same remark probably applies to a number of other foods, and, in fact, it has been argued that the low quality of the proteins fed is mainly responsible for the decline in yield as the lactation progresses.

For a number of years, Professor Hansen, of Berlin, has been investigating the specific effects of different foods for milk production, and he gave his general conclusions in a paper read to the World's Dairy Congress in London in 1928. He divided foods into four groups. The first group increased the milk yield, but lowered the fat percentage to about the same extent, so that the total amount of fat produced was unchanged ; this group included soya bean meal, ground maize, and ground oats. Another group had no effect on the milk yield, but lowered the fat percentage and consequently also the total weight of fat produced ; this group included sesame cake, poppy seed cake, and rice flour. A third group appeared to have no marked effect. His last group had little if any effect on milk yield, but increased the percentage of fat, and hence the total amount of fat produced. These would appear to offer the greatest possibilities, and the two showing the most marked effects were palm kernel and coconut cakes, which raised the yield of fat by 18 and 12 per cent., respectively. Kellner

also found that these two cakes increased the fat yield. This is interesting, as they are residues obtained when pressing out oils for margarine; in other words the fat they contain is as near butterfat as margarine is to butter—and though some may say that this is not very close, it is near enough to allow of a certain amount of deception. It is probable that if a fat is being digested which approximates more or less to butterfat in composition it may be transferred more readily into the milk. This would seem to be the explanation of the benefit derived from feeding these two cakes; this conclusion is strengthened by further figures given by Professor Hansen, who showed that the yield of fat was raised successively as the palm kernel cake fed was increased up to 12 lb. a day, and also that brands of this cake rich in fat (*i.e.*, oil) were more effective than those poor in fat—in other words, that the important ingredient in the food in this case was the fat, and not the protein.

Professor Hansen pointed out that it would be useless to search for these particular actions of foods unless they were being fed in considerable amounts; small quantities can be dealt with normally by the body, whereas large quantities will tend to swing processes over in a certain direction, and so make the body work abnormally, which is after all the continual aim with high-milking cows. The classic case in this connexion is with feeding dogs; it has been shown that if large amounts of an oily fat are given the fat on a dog's body will be made softer, but no effect is found when only small amounts are fed, even over a long period, for the body can then deal with them as they come along, and can convert them into its normal fat. Similarly, if it is required to improve the fat percentage of the milk by feeding palm kernel or coconut cake it is no use feeding an odd pound or two; rather will it be necessary to incorporate them boldly, so that they form a large part of the ration. In this respect it is fortunate that these two cakes are balanced foods, as this means that they can be added freely to a ration without upsetting its nutritive ratio.

A word should perhaps be said about this term "nutritive ratio," for though it has its uses it is beset with pitfalls. It is, essentially, the ratio of the non-protein nutrients in the food to the protein nutrients, and is calculated as

$$\text{Digestible Fat} \times 2.3 + \text{Digestible Carbohydrate} + \text{Digestible Fibre}$$

$$\text{Digestible Protein}$$

By this figure foods are readily classified on the basis of their richness in protein; with high protein foods the figure obtained

is a low one and the nutritive ratio is said to be a narrow one, whilst with starchy foods the figure is high and the ratio is said to be wide. In helping to pick out foods it has a definite place, but it is possible to be led seriously astray in calculating the nutritive ratio of a mixture; the only safe way in that case is to tot up the separate nutrients (fat, fibre, etc.) contained in the mixture and work it out afresh, and short cuts may lead to an answer that is very wide of the mark. It should be regarded as a purely descriptive figure, and should not be introduced into the calculations in rationing; in fact, it might well be argued that its advantages are problematical and that it should be dropped altogether—it is really only a “frill” in the science of rationing and can easily be dispensed with, and as a result of experience it is much less used nowadays than formerly.

The particular effects of foods on the animal body and their special influences on its behaviour are difficult to explain. Probably most cases can be met by assigning them to the quality of the proteins and fats contained in them. Other effects may be due to vitamins or minerals, or to physiological effects on the rate or efficiency of digestion: roots may owe much of their special value to factors such as these. In the aggregate, farmers spend considerable sums on spices, but it is more than doubtful if these have any real effect except in persuading animals to eat foods that would be better left alone; it should be possible to achieve palatability in a ration without resort to them. In general, foods, when they come to be fed under practical conditions, live up to the reputation established for them by chemical analysis and digestibility experiment in the laboratory; those few cases where they definitely do better or worse than expected will probably be cleared up eventually on the lines indicated above. Of course, it is possible that there are more things in nutrition than are dreamed of in our philosophy, but it will be a long time before men of science admit that there is any mysterious, intangible, manner in which particular foods may exert special influences on the working of the animal body.

DESCRIPTION	Price per qr.		Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.	Price per lb. starch equiv.	Pro- tein equiv.
	s. d.	lb.	£ s.	£ s.	£ s.		s. d.	d.	%
Wheat, British	—	—	5 12	0 11	5 1	72	1 5	0.76	9.6
Barley, British feeding	—	—	5 10	0 9	5 1	71	1 5	0.76	6.2
" Danubian	15 0	400	4 3	0 9	3 14	71	1 1	0.58	6.2
" Persian	14 3	"	4 0	0 9	3 11	71	1 0	0.54	6.2
" Russian	15 0	"	4 3	0 9	3 14	71	1 1	0.58	6.2
Oats, English, white	—	—	6 0	0 10	5 10	60	1 10	0.98	7.6
" black and grey	—	—	5 15	0 10	5 5	60	1 9	0.94	7.6
" Argentine	11 3	320	3 18	0 10	3 8	60	1 2	0.62	7.6
" Chilean tawny	13 6	"	4 15	0 10	4 5	60	1 5	0.76	7.6
" German	20 3	"	7 2†	0 10	6 12	60	2 2	1.16	7.6
" Russian	14 0	"	4 18	0 10	4 8	60	1 6	0.80	7.6
Maize, Argentine	17 0	480	4 0	0 9	3 11	81	0 11	0.49	6.8
Beans, English Winter	—	—	5 10‡	1 3	4 7	66	1 4	0.71	20
Peas, English Blue	—	—	7 0‡	1 0	6 0	69	1 9	0.94	18
" Indian	—	—	8 0†	1 0	7 0	69	2 0	1.07	18
" Japanese	—	—	15 5†	1 0	14 5	69	4 2	2.23	18
Dari	—	—	7 10	0 11	6 19	74	1 11	1.03	7.2
Milling offals—									
Bran, British	—	—	4 17	1 0	3 17	42	1 10	0.98	10
" broad	—	—	6 5	1 0	5 5	42	2 6	1.34	10
Middlings, fine, imported	—	—	5 15	0 16	4 19	69	1 5	0.76	12
" coarse, British	—	—	5 0	0 16	4 4	58	1 5	0.76	11
Pollards, imported	—	—	4 10	1 0	3 10	60	1 2	0.62	11
Meal, barley	—	—	5 10	0 9	5 1	71	1 5	0.76	6.2
" maize	—	—	5 12	0 9	5 3	81	1 3	0.67	6.8
" " South African	—	—	5 7	0 9	4 18	81	1 3	0.67	6.8
" " germ	—	—	5 12	0 14	4 18	85	1 2	0.62	10
" locust bean	—	—	5 5	0 7	4 18	71	1 5	0.76	3.6
" bean	—	—	8 15	1 3	7 12	66	2 4	1.25	20
" fish	—	—	18 0	2 19	15 1	53	6 0	3.21	48
Maize, cooked flaked	—	—	6 7	0 9	5 18	83	1 5	0.76	8.6
" gluten feed	—	—	5 15	0 18	4 17	76	1 3	0.67	19
Linseed cake, English, 12% oil	—	—	9 10	1 7	8 3	74	2 2	1.16	25
" " " 9% "	—	—	9 2	1 7	7 15	74	2 1	1.12	25
" " " 8% "	—	—	8 17	1 7	7 10	74	2 0	1.07	25
Soya bean cake, 5½% oil	—	—	7 10‡	1 18	5 12	69	1 7	0.85	36
Cottonseed cake—									
" " English, 4½% oil	—	—	4 17	1 5	3 12	42	1 9	0.94	17
" " Egyptian, 4½% "	—	—	4 10	1 5	3 5	42	1 7	0.85	17
Decorticated cottonseed meal, 7% oil	—	—	9 5*	1 18	7 7	74	2 0	1.07	35
Ground-nut cake, 6-7% oil	—	—	5 10*	1 5	4 5	57	1 6	0.80	27
Decorticated ground-nut cake, 6-7% oil	—	—	7 10	1 18	5 12	73	1 6	0.80	41
Palm kernel meal, 1.2% "	—	—	5 5‡	0 17	4 8	71	1 3	0.67	17
Feeding treacle	—	—	5 15	0 8	5 7	51	2 1	1.12	2.7
Brewers' grains, dried ale	—	—	4 5	0 16	3 9	48	1 5	0.76	13
" " " porter	—	—	3 17	0 16	3 1	48	1 3	0.67	13
Malt culms	—	—	4 10*	1 5	3 5	43	1 6	0.80	16
Dried sugar beet pulp (a)	—	—	4 2	0 8	3 14	65	1 2	0.62	5.2

* At Bristol.

† At Liverpool.

‡ At Hull.

(a) Carriage paid on 4-ton lots.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of December, 1930, and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative values of the feeding stuffs on offer to their local market by the method of calculation used in these notes. Thus, if palm kernel meal is offered locally at £ per ton, then since its manurial value is 17s. per ton as shown above, the food value per ton is 58 3s. Dividing the figure by 71, the starch equivalent of palm kernel meal as given in the table, the cost per unit of starch equivalent is 9d. Dividing this again by 32.4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 0.94d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculation a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own markets. The figures given in the table under the heading manurial value per ton are calculated on the basis of the following unit prices:—N., 8s. 6d.; P₂O₅, 2s. 11d.; K₂O, 8s. 4d.

Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follow :—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (imported)	71	6.2	4 2
Maize	81	6.8	4 0
Decorticated ground nut cake	73	41.0	7 10
" cotton cake	71	34.0	7 0

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 1.01 shillings, and per unit protein equivalent, 2.19 shillings. An explanation of the method of calculation employed is given in the Report of the Departmental Committee on Rationing of Dairy Cows.*

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The "food values" which it is recommended should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows are given in the November, 1930, issue of the Ministry's JOURNAL.)

FARM VALUES

Crops	Starch equivalent Per cent.	Protein equivalent Per cent.	Food value per ton, on farm £ s.
Wheat	72	9.6	4 14
Oats	60	7.6	3 17
Barley	71	6.2	4 5
Potatoes	18	0.6	0 19
Swedes	7	0.7	0 9
Mangolds	7	0.4	0 8
Beans	66	20.0	5 10
Good meadow hay	37	4.6	2 7
Good oat straw	20	0.9	1 2
Good clover hay	38	7.0	2 14
Vetch and oat silage	13	1.6	0 17
Barley straw	23	0.7	1 5
Wheat straw	13	0.1	0 13
Bean straw	23	1.7	1 17

* Obtainable from H.M. Stationery Office, Adastral House, Kingsway, W.C. 2. Price 6d. net.

MISCELLANEOUS NOTES

ARRANGEMENTS have been made for holding the Imperial Fruit Show for 1931 at the City Exhibition Hall, Manchester, from October 30 to November 7 next.

Imperial Fruit Show, 1931 At Leicester last year it was estimated that practically one-third of the entire population paid a visit to the show, and previous shows have been equally successful. The National Food Council will again stage an exhibit, and this year it is proposed to introduce a honey section, which should prove popular in the district, the adjacent county of Cheshire being one of the chief honey-producing centres in the country.

* * * * *

PRICES of agricultural produce in January were on average 30 per cent. higher than in the base years 1911-13 as compared with 26 per cent. and 48 per cent. re-

The Agricultural Index Number spectively a month and a year earlier.

With the exception of potatoes, which showed a sharp advance, the price changes in January were generally small. In the base years, however, prices in January were rather lower than in December, thus causing the indices for a large number of commodities to move upwards for the month under review, and the increase of four points in the general index number is largely due to this fact.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1926 :—

Month				Percentage increase compared with the average of the corresponding month in 1911-13.					
				1926	1927	1928	1929	1930	1931
January	..	..	..	58	49	45	45	48	30
February	..	..	..	53	45	43	44	44	—
March	..	..	..	49	43	45	43	39	—
April	..	..	..	52	43	51	46	37	—
May	..	..	..	50	42	54	44	34	—
June	..	..	..	48	41	53	40	31	—
July	..	..	..	48	42	45	41	34	—
August	..	..	..	49	42	44	52	35	—
September	..	..	..	55	43	44	52	42	—
October	..	..	..	48	40	39	42	29	—
November	..	..	..	48	37	41	44	29	—
December	..	..	..	46	38	40	43	26	—

Grain.—Wheat prices continued to fall during January, and the average was 6d. per cwt. lower than in December, the index number being reduced by 7 points to 24 per cent. below pre-war. In the case of barley, quotations were not materially altered on the month, but as a decline occurred in the corres-

ponding period of the base years, the index figure showed a rise of 3 points to 3 per cent. above 1911-13. Values for oats were slightly higher, and the index number advanced by 4 points to 16 per cent. below pre-war. As compared with a year ago, all three descriptions of grain were cheaper, wheat by 3s. 11d. per cwt., barley by 4d. and oats by 1s. 2d.

Live Stock.—Prices of fat cattle continued to move in an upward direction, and the index number rose by 7 points to 27 per cent. above pre-war. Fat sheep were about $\frac{1}{4}$ d. per lb. cheaper than in December, but as this reduction was proportionately smaller than that which occurred in the corresponding period of the base years, the index figure was 6 points higher at 50 per cent. in excess of 1911-13. Quotations for bacon pigs rose slightly, and the index figure was 8 points higher at 34 per cent. above pre-war. In the case of porkers, a reduction of nearly 6d. per score was recorded, but as a relatively more pronounced drop took place in the base period, the index for January appreciated by 4 points. Similarly, although values for dairy cows were about 7s. per head lower on the month, a rise of 3 points was recorded in the index number. Store cattle were a trifle dearer at 28 per cent. in excess of 1911-13, but store sheep showed little change either in price or index number. Values for store pigs showed a slight rise, and the index number was 10 points higher at 114 per cent. over pre-war.

Dairy and Poultry Produce.—Milk was a little cheaper on average at 62 per cent. above the level of the base years. Butter prices were maintained, and the index figure rose by 2 points, while the index for cheese was 5 points higher on the month at 21 per cent. above pre-war. Eggs were about 4d. per dozen cheaper than in December, but as a proportionately greater reduction occurred in the base years, the index figure appreciated by 9 points to 23 per cent. over 1911-13. Quotations for poultry moved upwards and the index number showed an advance of 16 points to 47 per cent. above pre-war levels.

Other Commodities.—A further sharp advance was recorded in potato prices during January, and the index figure was 22 points higher at 71 per cent. above 1911-13, whereas a year ago potatoes were 4 per cent. cheaper than pre-war. Hay was practically unchanged either in price or index number. Vegetables generally were dearer at 45 per cent. above the level of the base years. Values for wool continued to decline, and the January index figure was 3 points lower on the month at 22 per cent. below 1911-13.

Index numbers of different commodities during recent months and in January, 1929 and 1930, are shown below :—

Percentage increase as compared with the average prices ruling in the corresponding months of 1911-13.

Commodity	1929	1930				1931
	Jan.	Jan.	Oct.	Nov.	Dec.	Jan.
Wheat	30	30	—7*	—11*	—17*	—24*
Barley	26	7	13	11	Nil	3
Oats	34	1	—12*	—17*	—20*	—16*
Fat cattle	35	38	31	28	20	27
„ sheep	67	67	62	53	44	50
Bacon pigs	40	90	25	29	26	34
Pork „	52	98	45	50	53	57
Dairy cows	33	33	30	31	30	33
Store cattle	23	25	27	23	22	28
Store sheep	59	55	62	56	50	48
Store pigs	52	137	107	111	104	114
Eggs	56	40	56	33	14	23
Poultry	45	44	39	36	31	47
Milk	70	67	47	57	65	62
Butter	53	44	14	10	12	14
Cheese	78	37	17	16	16	21
Potatoes	31	—4*	40	46	49	71
Hay	6	38	—4*	—7*	—7*	—8*
Wool	72	32	—12*	—17*	—19*	—22*

* Decrease.

* * * * *

THE trials which are arranged each year by the Ministry with the object of testing new varieties of potatoes for immunity from Wart Disease were again

Trials of Potatoes conducted in 1930 on the farm of the National Institute of Agricultural Botany, Ormskirk, Lancashire. The actual field operations and the taking of records were

carried out by Mr. Harold Bryan, B.Sc., and Mrs. McDermott, of the Institute, but the trials were conducted on a plan approved by the Ministry.

Forty-seven stocks were included in the second and subsequent years' tests, and all remained immune from Wart Disease. Of the 48 entries for the first year's tests, 6 became infected in the field; 6 proved to be synonyms of existing varieties; 5 were too poor to judge and 36 were distinct varieties.

As in previous years, the results of the trials have been considered by a small committee composed of representatives

of the Ministry of Agriculture and Fisheries, the Department of Agriculture for Scotland and the Ministry of Agriculture for Northern Ireland, and co-ordinated with the results of the trials carried out by the two last-named Departments at Philpstoun and Kilkeel respectively.

The Committee recommended the approval of 38 new varieties, but only 3 of these have actually been added to the approved list. In the remaining cases inclusion has been postponed until such time as the raisers have intimated that the varieties have actually been or will shortly be introduced into commerce. Descriptions are given below of the 3 new varieties, together with those of 8 varieties which were approved as the result of trials carried out in previous years, and which are now being introduced into commerce.

The findings of the Potato Synonym Committee of the National Institute of Agricultural Botany have been accepted by the Ministry where recommendations as to the classification of new varieties as synonymous with existing varieties have been made by that Committee.

A list of the names of varieties which have been approved in recent years as immune from Wart Disease and those of the older approved immune varieties which are known to the Ministry to be in general cultivation in England and Wales may be obtained on application to the Ministry.

EARLY VARIETY

"Arran Pilot"

- | | | |
|--------------------------|----|--|
| <i>Sprout</i> | .. | Blue. |
| <i>Tuber</i> | .. | Thick kidney, slightly pointed heel; skin white; flesh pale lemon; eyes shallow; sprout blue. |
| <i>Haulm and Foliage</i> | | Medium height, strong, upright spreading towards maturity, irregular growth; medium to dark green; leaflets dense appearance of top growth, terminal leaflet to the perpendicular, lateral leaflets overlapping terminal; leaflets leathery wrinkled appearance; secondary leaflets small and inconspicuous; leaf short; wings straight; stems reddish purple tinge, especially at base. |
| <i>Flowers</i> | .. | Blue-purple, tipped white, not numerous; long styles; orange anthers. |

SECOND EARLY VARIETIES

"Arran Luxury"

- | | | |
|--------------------------|----|---|
| <i>Sprout</i> | .. | Pink. |
| <i>Tuber</i> | .. | Thick kidney shaped; skin white; eyes shallow; flesh white. |
| <i>Haulm and Foliage</i> | | Medium height, spreading; stems branching, wings slightly waved; leaf open, rigid; terminal leaflet well clear of last pair of side |

- leaflets; leaflets medium, dull, with long stalks.
- Flowers* .. Absent; buds purple with green markings; hairs numerous and upstanding.
- " Ballydoon "**
- Sprout* .. Pink.
- Tuber* .. Oval; skin white; flesh white; eyes shallow.
- Haulm and Foliage* Medium height, spreading, stems branching, main stems strong; leaf open, rigid; leaflets medium to dark green, broad.
- Flowers* .. White, large and profuse; stalks long and strong; anthers orange; buds dark with green tips; berries occur.
- " Cramond Peach "**
- Sprout* .. Pink.
- Tuber* .. Round; skin white; flesh yellow; eyes shallow.
- Haulm and Foliage* Low-growing, spreading; yellow-green colour; leaf close, arched; leaflets long, large, lateral leaflets overlapping terminal, hard, wrinkled, dull; secondary leaflets large, numerous, frequently on leaflet stalks; pink mottling general.
- Flowers* .. None observed.

EARLY MAINCROP VARIETIES

" Albion "

- Sprout* .. Pink.
- Tuber* .. Round; skin white; flesh white; eyes shallow.
- Haulm and Foliage* Medium height to tall, spreading; stems branching, tinged red purple, strong; wing broad; leaflets medium green, slightly wrinkled.
- Flowers* .. White and profuse; stalks long and strong; buds dark.

" Impressive "

- Sprout* .. Pink.
- Tuber* .. Oval, skin white; flesh pale lemon; eyes shallow.
- Haulm and Foliage* Moderately tall, compact, upright; colour grey-green; leaflets round, dull; secondary leaflets few, inconspicuous; wings straight; pink colouration at base only.
- Flowers* .. None observed; buds pink, drop.

" Sutton's Commander "

- Sprout* .. Pink.
- Tuber* .. Oval, skin white; flesh lemon; eyes shallow and on the point.
- Haulm and Foliage* Tall, open, upright, vigorous; leaf close, erect; leaflets dark yellow-green, round, pointed, wrinkled, dull; secondary leaflets small, few; wings straight; stems mottled pink especially in the axils, extending to mid-ribs and petioles.
- Flowers* .. White, large, numerous; orange anthers; dark hairy buds,

LATE MAINCROP VARIETIES

"Donard"

- Sprout* .. Pink.
Tuber .. White, oval; eyes shallow.
Haulm and Foliage Medium height to tall, spreading; stems branching; leaf long and spreading; top leaves show a faint tinge of pink at base of leaflet stalks; leaflets light to medium green, large end pair do not as a rule overlap the terminal leaflet; secondary leaflet large and well developed.
Flowers .. None observed; flower buds small and purple, becoming pink before dropping off.

"Late Exon"

- Sprout* .. Pink.
Tuber .. Kidney; skin white; flesh lemon, soft; eyes shallow to medium.
Haulm and Foliage Tall, open, upright, weak; leaf open, erect; leaflets very small, stiff appearance; secondary leaflets small; wings slightly serrated; slight reddish purple mottling general.
Flowers .. White; dark buds; orange anthers.

"Latest of All"

- Sprout* .. Faint pink.
Tuber .. Kidney, irregular; skin white; flesh white; eyes shallow.
Haulm and Foliage Medium height, moderately strong, upright; colour light yellow-green; leaf erect, rigid appearance; leaflets small, terminal leaflets pointing upwards, hard; secondary leaflets inconspicuous; wings straight; numerous thin green stems.
Flowers .. White; orange anthers.

"Whoppers"

- Sprout* .. Pink.
Tuber .. Kidney; skin white; flesh lemon; eyes shallow.
Haulm and Foliage Medium height, weak, open, irregular; colour grey-green; leaflets small, dull, harsh appearance; secondary leaflets small; slight reddish purple colouration general, extending to midrib.
Flowers .. White; orange anthers.

THE first experiment with an Organized Day Class for Girls in Essex seems to show that there is quite a definite demand for this type of agricultural instruction. Twenty-two students (farmers' daughters) were readily obtained for the course which began in January of this year and is now in progress. The class meets in Colchester on one day a week. The subjects dealt with are;—

**Organized
Day Class for Girls
in Essex**

Dairying.—Composition of milk ; cream separating and ripening; butter and soft cheese making.

Poultry Keeping.—Breeds of poultry ; hatching and rearing of chicks ; feeding and general management of diseases.

Horticulture.—Fruit, vegetable and flower culture ; fruit and vegetable bottling ; jam and jelly making, etc.

Agriculture.—Rearing of calves ; farm accounts, etc.

Lectures are given during the morning session, visits being paid in the afternoon to neighbouring farms and gardens, where the actual operations described in lectures can be demonstrated.

The first visit was made to a fruit farm, belonging to Mr. H. C. Tann, of Aldham. Here a pruning demonstration was given and the class was able to see the whole story of the production of high-grade apples from the planting of a maiden tree onwards. The following week a farm producing Grade A milk was visited, when Mr. Marsh, chief sanitary inspector for the county, was present to address the class.

It is felt that a great deal of useful work can be done, even in so varied a course, and it is hoped that, for some of the students, it will lead on to attendance at some longer and more specialized course at the Institute of Agriculture, Chelmsford.

* * * * *

Farm Workers' Minimum Wages.—A meeting of the Agricultural Wages Board was held on Tuesday, February 10, 1931, at 7 Whitehall Place, London, S.W.1, the Right Hon. the Viscount Ullswater, G.C.B., presiding.

The Board considered notifications from Agricultural Wages Committees of decisions fixing minimum and overtime rates of wages, and proceeded to make the following Orders carrying these decisions into effect.

Bedfordshire and Huntingdonshire.—An Order cancelling as from March 28 the existing minimum and overtime rates of wages for male and female workers, and fixing fresh rates to come into operation on March 29. The minimum rate in the case of male workers of 21 years of age and over is 30s. 6d. per week of 41 hours in the weeks in which Easter Monday and Whit Monday fall, 50 hours in any other week in summer ; 31 hours in the week in which Christmas Day and Boxing Day fall, and 48 hours in any other week in winter (instead of 50 hours per week in summer and 48 hours per week in winter as at present). The overtime rates in the case of male workers of 21 years of age and over are 11d. per hour on Sundays, 10d. per hour on Easter Monday, Whit Monday, Christmas Day and Boxing Day, and 9d. per hour for all other overtime employment. In the case of female workers of 18 years of age and over the minimum rate is 6d. per hour with overtime at 9d. per hour on Sundays, 8½d. per hour on Easter Monday, Whit Monday, Christmas Day and Boxing Day, and 7½d. per hour for all other overtime employment. These rates will continue in force until February 27, 1932.

Devonshire.—An Order fixing minimum and overtime rates of wages to come into operation on March 28, 1931, i.e., the day

following that on which the existing rates are due to expire. The minimum rate in the case of male workers of 21 years of age and over is 32s. 6d. per week of 52 hours in summer, 41 hours in the week in which Good Friday falls; 32 hours in the week in which Christmas Day and Boxing Day fall and 50 hours in any other week in winter, with overtime at 8½d. per hour on weekdays and 10d. per hour on Sundays and for all overtime employment on the hay and corn harvests. The minimum rate in the case of female workers of 20 years of age and over is 5d. per hour for all time worked. These rates will continue in operation until March 26, 1932.

Kent.—An Order continuing the operation of the existing minimum and overtime rates of wages from March 1, 1931, until February 29, 1932. The minimum rate in the case of horsemen, stockmen or shepherds of 21 years of age and over is 33s. per week of 42½ hours in the weeks in which Good Friday and Christmas Day fall and 52 hours in any other week with, in addition, 8d. per hour for all employment on customary duties in excess of those hours, but not exceeding 60 hours in any week (including Sunday). The overtime rate in the case of these workers is 9d. per hour except for employment on other than customary duties on Sundays, Good Friday and Christmas Day when the rate is 10d. per hour. In the case of other male workers of 21 years of age and over the minimum rate is 32s. 6d. per week of 42½ hours in the week in which Good Friday falls and 52 hours in any other week in summer; 39 hours in the week in which Christmas Day falls and 48 hours in any other week in winter, with overtime at 9d. per hour on weekdays and 10d. per hour on Sundays, Good Friday and Christmas Day. In the case of female workers of 18 years of age and over the minimum rate is 5½d. per hour with overtime at 6½d. per hour on weekdays and 7d. per hour on Sundays, Good Friday and Christmas Day.

Lincolnshire (Kesteven and Lindsey).—An Order continuing the operation of the existing minimum and overtime rates from March 2, 1931, until March 6, 1932. The minimum rate in the case of waggoners of 21 years of age and over is 39s. per week of 53 hours in summer and 48 hours in winter and such additional hours as may be required for the performance of the customary duties of such workers, but so that the total number of hours per week shall not exceed 61 during the period from October 15 to May 13, and 58 during the remainder of the year. In the case of shepherds of 21 years of age and over the minimum rate is 37s. per week of 53 hours in summer and 48 hours in winter and such additional hours as may be necessary for the performance of customary duties, but so as not to exceed a total of 55 in summer and 56 in winter, additional payments being made for the lambing season. In the case of stockmen of 21 years of age and over the minimum rate is 38s. per week of 53 hours in summer and 48 hours in winter and such additional hours as may be required for the performance of customary duties, but so that the total number of hours per week shall not exceed 56 in summer and 58 in winter. In the case of other male workers of 21 years of age and over the minimum rate is 32s. per week of 48 hours in winter and 53 hours in summer. The overtime rate for all classes of male workers of 21 years of age and over are 9½d. per hour on weekdays and 11½d. per hour on Sundays. The minimum rate of wages for female workers of 17 years of age and over is 5½d. per hour for all time worked.

Middlesex.—An Order continuing the operation of the existing minimum and overtime rates of wages from March 1, 1931, to February 29, 1932. The minimum rates in the case of male workers of 21 years of age and over are, for stockmen 41s. 3d. per week of 60 hours; for carters 38s. 6d. per week of 56 hours; for casual workers 8½d. per hour and for other male workers 34s. 4½d. per week of 50 hours in summer and 33s. per week of 48 hours in winter, with overtime in each case at 10½d. per hour. The minimum rates in the case of female workers of 18 years of age and over are, for stockmen 30s. per week of 60 hours; for carters 28s. per week of 56 hours; for casual workers 6d. per hour and for other female workers 25s. per week of 50 hours in summer and 24s. per week of 48 hours in winter, with overtime in each case at 7½d. per hour.

Monmouthshire.—An Order continuing the operation of the existing minimum and overtime rates of wages from March 16, 1931, to March 15, 1932. The minimum rate in the case of male workers of 21 years of age and over is 32s. per week of 54 hours in summer and 50 hours in winter, with overtime at 9½d. per hour on weekdays and 11½d. per hour on Sundays, Good Friday, Easter Monday, Whit Monday, August Bank Holiday, Christmas Day and Boxing Day. In the case of female workers of 17 years of age and over the minimum rate is 6d. per hour for all time worked.

Worcestershire.—An Order fixing minimum and overtime rates of wages to come into operation on March 1, 1931, i.e., the day following that on which the existing rates are due to expire, and to continue in force until March 5, 1932. The minimum rate in the case of male workers of 21 years of age and over is 30s. per week of 43 hours (instead of 41½ hours as at present) in the week in which Good Friday falls and 52 hours (instead of 50½ hours as at present) in any other week in summer; 39½ hours in the week in which Christmas Day falls and 48 hours in any other week in winter. The overtime rate in the case of male workers of 21 years of age and over is 9d. per hour (instead of 8d. per hour on Good Friday and Christmas Day and 9d. per hour for all other overtime employment as at present). In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour with overtime at 5½d. per hour.

East Riding of Yorkshire.—An Order fixing special differential rates of wages for overtime employment on the corn harvest in 1931, the rates in the case of male workers boarded and lodged by their employers being 1s. per hour for foremen, beastmen, shepherds and waggoners, with lesser rates for lads. In the case of other male workers of 21 years of age and over the rate is 1s. 3d. per hour and for female workers of 16 years of age and over 11d. per hour.

Denbigh and Flint.—An Order continuing the operation of the existing minimum and overtime rates of wages from February 16, 1931, until February 15, 1932. The minimum rate in the case of teamsmen, cattlemen, cowmen, shepherds or bailiffs of 21 years of age and over is 37s. per week of 61 hours, and in the case of other male workers of similar age 30s. 6d. per week of 50 hours, with overtime in each case at 9d. per hour. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour for a week of 48 hours, with overtime at 6½d. per hour.

Glamorgan.—An Order continuing the operation of the existing minimum and overtime rates of wages from March 2, 1931, until March 1, 1932. The minimum rate in the case of stockmen, cattlemen, cowmen, horsemen, shepherds or bailiffs of 21 years of age and over is 39s. per week of 60 hours with overtime at 11d.

per hour, and in the case of other male workers of 21 years of age and over the minimum rate is 35s. per week of 52 hours in summer and 48 hours in winter, with overtime at 10d. per hour on weekdays and 11d. per hour on Sundays. In the case of female workers of 18 years of age and over the minimum rate is 6d. per hour with overtime at 7d. per hour on weekdays and 7½d. per hour on Sundays.

Copies of the Orders in full may be obtained on application to the Secretary of the Agricultural Wages Board.

* * * * *

Enforcement of Minimum Rates of Wages.—During the month ending February 14, legal proceedings were instituted against nine employers for failure to pay the minimum rates of wages fixed by the Orders of the Agricultural Wages Board.

Particulars of the cases are as follows:—

County	Court	Fines			Costs			Arrears of wages		No. of workers involved
		£	s.	d.	£	s.	d.	£	s.	
Cheshire ..	Middlewich..	—	—	—	0	8	0	32	2	4
Derby ..	Chapel-en-le- frith	4	0	0	1	0	0	22	0	4
Gloucester ..	Cheltenham ..	5	0	0	—	—	—	45	10	3
Lancashire ..	Blackburn ..	3	0	0	3	11	2	28	19	3
Yorks, N.R. ..	Flaxton ..	0	5	0	—	—	—	1	4	9
„ W.R. ..	Halifax ..	5	0	0	—	—	—	5	10	6
Anglesey ..	Llanerchymedd	*	—	—	—	—	—	—	—	1
Carmarthen..	Llandilo ..	*	—	—	—	—	—	—	—	2
„ ..	„ ..	†	—	—	1	2	6	4	4	6
		£17	5	0	£6	1	8	£139	11	7
										15

* Case dismissed.

† Dismissed under Probation of Offenders Act

* * * * *

Foot and Mouth Disease.—During the present year, two isolated outbreaks of foot-and-mouth disease have been confirmed in Great Britain. The first occurred at Stanmer, Lewes, Sussex, on January 18, and the second at Aspley Guise, Bletchley, Bedfordshire, on January 26. In connection with these outbreaks the usual restrictions were imposed upon areas of approximately 15 miles radius round the infected premises. These restrictions were withdrawn, in respect of the former outbreak on February 9, and in respect of the latter on February 17. The position as this issue goes to press is that there is no part of Great Britain subject to general foot-and-mouth disease restrictions.

* * * * *

APPOINTMENTS

COUNTY AGRICULTURAL EDUCATION STAFFS : ENGLAND

Hampshire : Mr. W. C. Ibbett,* N.D.H., has been appointed Assistant Horticultural Instructor.

Lancashire : Miss N. S. Milne, N.D.D., has been appointed Assistant Poultry Instructress, *vice* Miss W. W. Young.

* Wholly employed by the County Council, but only partially on agricultural education work.

INDEX TO VOL. XXXVII.

APRIL, 1930, TO MARCH, 1931.

"Notes for the Month" and "Miscellaneous Notes" are indexed under the subjects to which they refer.

	PAGE
Accounts, see <i>Book-keeping</i>	
Acts of Parliament, etc.:	
American Marketing Act	1226
Agricultural Marketing Bill	600, 891, 901, 950, 1018, 1234
Amendment of Agricultural Holdings Act, 1923	380
Diseases of Animals Acts: Report for 1929	749
Fertilizers and Feeding Stuffs Act, 1928:	
Questions and Answers	50
Prosecutions under	900, 1237, 1249
Horse Breeding Act, 1918: Licensing of Stallions under	809
Land Drainage Act, 1930	528
Seeds Act, 1930: Operation during Season, 1929-30	996
Union of South Africa:	
Agricultural Warehouse Act, 1930	702
Dairy Industry Control Act, 1930	701
Packing and Marking of Agricultural Products Act, 1930	240
Public Auctions and Transactions in Livestock and Produce (Amendment) Act, 1930	239
Agriculture, General:	
Chancellor of the Exchequer's Statement	525
Conference	1
Council of Agriculture:	
Minister's Statement	373
Resolution on Policy	897
County Agricultural Education, Minister's Speech	205
Agricultural Returns and Statistics:	
Agricultural Index Number	89, 188, 287, 405, 511, 627, 720, 839, 934, 1046, 1157, 1267
Agricultural Statistics (Part II), 1929	1065
Annual Returns of Crops and Livestock	212, 609, 941, 1026
Sugar Beet Crop in England and Wales, 1929	4
Agricultural Students, see <i>Research and Education</i>	
Agricultural Wages, see <i>Wages</i> .	
Agricultural Workers, see <i>Labour</i> .	
Allotments, see <i>Small Holdings and Allotments</i> .	
Animals, see <i>Livestock and Diseases and Pests of Animals</i> .	
Apples, see <i>Fruit</i> .	
Appointments:	
Changes and Corrections	193, 293, 411, 516, 633, 730, 843, 942, 1055, 1160, 1276
Armstrong, S. F.:	
Results of Sugar Beet Variety Trials in England	63
Bacon, see <i>Meat</i> .	
Barkworth, H.: Influence of Fat-Content on the Keeping Quality of Milk	803
Barley, see <i>Cereals</i> .	
Barnes, H. F.: Control of Meadow Foxtail Midges	694
Basic Slag, see <i>Manures</i>	
Bates, G. H.: Effect of Consolidation upon Botanical Composition of Poor Grass Land	583
Beef, see <i>Meat and Marketing</i> .	
Bees: Blind Louse of the Honey Bee	1176
Beet, see <i>Root Crops or Sugar Beet</i> .	
Belgium, Agricultural Fortnight	724
Beshir, M., and A. M. Massees: Control of Apple Blossom Weevil	164
Book-keeping:	
Agricultural Accounting in Wiltshire	493
Economic Research in Agriculture	24

	PAGE
British Columbia, Milk Inquiry Commission	490
Broadcasting :	
Agricultural Market Information	651
Livestock in Relation to Tillage	209
Brown, Sir Edward : Fifty Years of the Poultry Industry	321
Building, <i>see Housing</i> .	
Butter, <i>see Dairying</i> .	
Calendar Reform	206
Canada :	
Farming Tour in	287
Saskatchewan Wheat Pool	489
Canning, <i>see Fruit or Vegetables</i> .	
Cattle, <i>see Livestock</i> .	
Cereals :	
Barley, Experiments in Fertilizers	800
Barley, Manures for	1146
Malt Products, National Mark	42, 236, 594, 1012
Varieties for Autumn Sowing	630
Varieties for Spring Sowing	952
Wheat Flour, National Mark	41, 143, 235, 357, 485, 594, 818, 912, 1011, 1127
Wheat Pool in Saskatchewan, Proposed Compulsory	489
Cheese, <i>see Dairying</i> .	
Cider :	
Improvement of English	1095
National Mark	912, 1012, 1217
Claying of Fen Lands	113
Clover, <i>see Pasture</i> .	
Colleges, Research Stations, etc. :	
Cheshire School of Agriculture	553
County Farm Institute Courses	626
Essex, Agricultural Instruction in	1067
Hannah Dairy Research Institute	513, 632
Kent County Farm Institute, Minister's Speech	205
Norfolk Agricultural Station, Trials in Bullock Feeding ..	210
National Institute of Agricultural Botany : Note on Varieties of Potatoes	1169
Note on Potato Synonyms	1171
Reassessment of Grants : Higher Agricultural Education ..	85
Sparsholt Farm Institute, Poultrymen's Short Courses ..	1062
Collinge, W. E. : Food and Feeding Habits of Some Corvidæ ..	151
Commissions, Committees and Councils, <i>see also Council of Agriculture</i> .	
Horticultural Advisory Council	1068
Imperial Economic Committee, Report on Hides and Skins ..	915
Pig Industry Council	49, 604
Rural Community Councils, Conference of,	537
Competitions :	
Clean Milk Competitions	1115
Dressed Poultry Competition at Gloucestershire Show	1017
Eriksson Prizes	1050
Farm Institute Livestock Judging Competition	421
International Cow Judging, Young Farmers' Club	427
New Forest Grassland Competition, 1929	575
Conferences and Congresses :	
Agricultural Conference	1
Agricultural Fortnight in Belgium	112
Allotments for Unemployed, Conference on	949
Angora Agricultural Congress and Exhibition, 1931	938
Antwerp Exhibition, Dairying Fortnight	208
Dairy Instructors' Conference, 1930	848
Fifteenth International Agricultural Congress, 1931	841
Imperial Bureau of Soil Science : Conference	409, 750
Imperial Horticultural Conference, 1930	110, 426, 534
Poultry Instructors' Conference, 1930	849

Congresses and Conferences: (<i>continued</i>)	PAGE
Rothamsted Conference, 1931, on The Making of New Grass Land	1165
Rural Community Councils Conference	537
Rural Women's Organizations: Conference	302
World's Grain Exhibition and Conference, Canada, 1932	304, 1061
World's Poultry Congress, 1930	114, 301, 673
Co-operation, see also <i>Young Farmers' Clubs</i> :	
Loans to Co-operative Marketing Enterprises	366
Corn, see <i>Cereals</i> .	
Corvidae, Food and Feeding Habits of Some (Carrion Crow, Hooded Crow, Magpie and Jay)	151
Costings, see <i>Book-keeping</i> and <i>Farm Values</i> .	
Council of Agriculture for England:	
Reports of Meetings	373, 891, 1234
Reports of the Standing Committee of the Council on:	
Agricultural Marketing Bill	901
Disinfection of Poultry Crates and Pens	393
Dressed Poultry	385
Fertilizers and Feeding Stuffs Act (1926), Prosecutions under	1249
Grading of Milk for Sale	382
Law relating to the Sale of Milk	386
Marketing of Home-Produced Cheese	1242
Potato Position	391
Cows, see <i>Livestock</i> .	
Cranfield, H. T.: Effects of Abnormal Weather Conditions on Quality of Milk	347
Crops, see under specific names.	
Crowther, C.: Value of Whole Milk and Separated Milk for Pig Feeding	541
Cultivation:	
April Operations	71
Claying of Fen Lands	113
Livestock in Relation to Tillage	209
Sugar Beet	5
Sugar Beet Variety Trials Results	63
Currie, J. F., and T. Whitehead: Potato Leaf-Roll, Development of Secondary Symptoms in Year of Infection	159
Cuthbert Clarke, an Eighteenth-Century Book-Farmer	571
Dairying; see also <i>Competitions</i> .	
Better Milk and the Health Visitor	414
Butter and Cheese, South African Export Bounties	1137
Butter, Iowa "National Mark"	1129
Butter Marketing, Quality Control	238
Cheese Control in East Prussia	1019
Cheese Marketing in England and Wales	822
Cheese making, Revision Course for Dairy Instructors	307, 936
Clean Milk Production, Instruction in	1115
Cowmen, Short Course for	850
Cows, Winter Food Mixtures for	756
Dairy Farming Systems	953
Dairying Rationalization in Germany	1135
Hannah Dairy Research Institute	513
Milk, Effects of Abnormal Weather Conditions on Quality	347
„ Grading for Sale	375
„ Influence of Fat-Content on Keeping Quality	803
„ Inquiry Commission in British Columbia	490
„ Law relating to Sale	378
„ Recording, Livestock Improvement Report	466
„ Reorganization of Industry	1018
„ Report of Standing Committee of the Council of Agriculture for England on Grading	382
„ Report of Standing Committee of the Council of Agriculture for England on Law relating to	386
„ Scottish Agency	1137
„ Value of Whole and Separated, for Pig Feeding	541
Small Dairy Holdings, Soiling Crops on	309

	PAGE
Danish Committee on Marketing	863
Davies, W. Maldwyn :	
Control of Warble Flies in North Wales	862
Damage to Mangolds by Rodents	269
Davies, W. Morley : Cultivation of Sugar Beet : Three Years' In-	
vestigations of the Effects of Spacing	973
Dawe, C. V. : Agricultural Accounting in Wiltshire	493
Dawson, R. B., and T. W. Evans : Establishment of Grasses on	
Very Acid Moorland	1188
Diseases and Pests of Animals :	
Diseases of Animals Acts : Report for 1929	749
Foot-and-Mouth Disease 94, 193, 732, 758, 843, 940, 1054, 1276	
Fowl Pox, Vaccine for	1168
" John's " Disease 381, 1066	
Liver Fluke	707
Navel-Il in Sucking Pigs	305
Nematode Parasites of Sheep in East Sussex	681
Veterinary Research Scholarships	9
Warble Flies, Control of in North Wales	862
Diseases and Pests of Plants :	
Apple Blossom Weevil Control	164
Apple Capsid Bug, Winter Spraying for Control of the	1078
Black Currant Leaf Spot Disease and Its Control	255
Cabbage Root Fly, Control of	1227
Capsid Bugs on Black Currants, Control of	475
Cereal Smuts	1168
Coloured Diagrams of Some Pests and Diseases of Fruit Trees	649
Common Green Capsid Bug on Red Currants, Control of	1185
" Dry Pickling " Seed Wheat to prevent Bunt	429
Imperial Bureau of Mycology	753
Meadow Foxtail Midges, Control of	694
Potato Leaf-Roll, Development of Secondary Symptoms in	
the Year of Infection	159
Potato Virus Diseases, Insects in Relation to	224
Red Bud Borer, Control of	59
Wart Disease Immunity Trials 190, 1156	
Watery Wound Rot of Potato Tuber	335
Drainage :	
Farm Drainage Records	955
Field Drainage, Rural Water Supply and Claying of Fen	
Lands 113. 532	
Land Drainage Act, 1930	528
Duckham, A. N. : Bajra or Bullrush Millet as Feed for Pigs	108
Dunlop, W. R. : Improvement of Farm Labour and Its Management	
by Education	782
Education, Agricultural, see <i>Research and Education</i> .	
Eggs, see <i>Poultry</i> .	
Egypt, Agricultural Exhibition in	724
Empire Marketing Board, see <i>Marketing</i> .	
Employment, see <i>Labour</i> .	
Engineering, see <i>Machinery</i> .	
Ensilage : Precautions to be taken when filling Silos	567
Evans, T. W., and R. B. Dawson : Establishment of Grasses on very	
Acid Moorland	1188
Exhibitions and Shows :	
Agricultural Fortnight in Belgium	112
Angora Agricultural Exhibition	938
Demonstrations of Combine Harvesters	421
Displays of Home Produce 49, 144, 238, 486, 700, 820, 915, 1017,	
1129, 1220	
Egyptian Agricultural Exhibition	724, 938
Horticultural Machinery, Demonstrations of	652
Marketing Demonstrations 49, 360, 487, 596, 820, 915, 1017	
Summer Demonstrations at Rothamsted and Woburn	289
" The House that John Built "	846

Exhibitions and Shows: (<i>continued</i>)	PAGE
World's Grain Exhibition and Conference, 1932	1061
World's Poultry Congress, 1930	114, 301, 673
World Tractor Trials	426, 754
Export of Breeding Stock	86, 87, 408, 723, 1049
Export Regulations, see <i>Import and Export Regulations</i> .	
Farm Notes (Monthly)	70, 172, 276, 394, 498, 616, 704, 824, 919, 1030, 1142, 1252
Farm Values of Feeding Stuffs (Monthly)	83, 186, 284, 403, 509, 625, 719, 838, 932, 1044, 1154, 1266
Featherstone, J. S. : Sheep Shearing	134
Feeding and Feeding Stuffs :	
Animal Nutrition, Imperial Bureau of	219
Bajra or Bullrush Millet as a Feed for Pigs	108
Barley Meal	108
Cheaper Maize for Poultry Feeding in Germany	598
Dairy Heifers, Feeding of	503
Economical Feeding of Stock	956
Factors Affecting Efficiency in Digestion	80
Farm Values of	83, 186, 284, 403, 509, 625, 719, 838, 932, 1044, 1154, 1266
Feeding Value of Roots, Hay and Straw	688
Fertilizers and Feeding Stuffs Act, 1926	
Some Questions and Answers	50
Prosecutions under	900, 1237, 1249
Home-grown Feeding Stuffs	1063
Monthly Notes on	80, 182, 281, 399, 503, 620, 713, 833, 928, 1039, 1151, 1175, 1261
Phosphorus Poisoning in Sheep	56
Pig Feeding, Value of Whole and Separated Milk	541
Pig Feeding, Methods	344
Prices of Feeding Stuffs (Monthly)	84, 187, 285, 404, 508, 624, 718, 837, 933, 1043, 1185, 1266
Rations for In-Pig Sows	643
Role of Vitamins and Minerals in Stock Feeding :	
I. Vitamins	18
II. Minerals	115
Sows and their Litters, Feeding of	417
Tapioca Meal as Food for Pigs	885
Winter Food Mixtures	756
Fen Lands, Claying of	113
Fertilizers, see <i>Manures</i> .	
Fishwick, V. C. :	
Feeding of Sows and Their Litters	417
Navel-ill in Sucking Pigs	305
Pig-keeping in Kent	341
Rations for In-Pig Sows	643
Flour, see <i>Cereals</i> .	
Flowers : Glasshouse Industry, Assistance for British	211
Flower Bulbs, Importation into Germany	729
Foot-and-Mouth Disease, see <i>Diseases of Animals</i> .	
Fruit, see also <i>Spraying and Cider</i> .	
Apples and Pears, National Mark	40, 235, 482, 593, 699, 817, 910, 1126
Apple Blossom Weevil, Control	164
Apples, Carton Packages for	146
Apples, Importation of American	510
Apples, Research and the Breeding of	765
Black Currants, Control of Capsid Bugs on	475
Cherries, Importation of	308
Cherries, National Mark	367, 482, 593, 1125, 1217
Crop Intelligence	105
Fruit Production, Imperial Bureau of	328
Fruit Schemes, Review of National Mark	906
Glasshouse Industry, Assistance for British	211
Imperial Fruit Show, 1931	1267

Fruit: (<i>continued</i>)	PAGE
International Horticultural Congress, 1930	8
Jam Standards	917
National Mark Canned Fruit 237, 358, 483, 593, 699, 818, 911, 1011, 1126	
Spraying in High-grade Fruit Production	1064
Strawberries, National Mark 143, 251, 355, 482, 593, 1011, 1122, 1217	
Fungi: see <i>Diseases of Plants and Spraying</i> .	
Fussell, G. E.:	
Cuthbert Clarke, An Eighteenth-Century Book-Farmer ..	571
Leonard Meager and the "Mystery of Husbandry"	879
Thomas Hitt, An Eighteenth-Century Heathland Farmer ..	1198
Garner, H. V.: Monthly Notes on Manures .. 74, 177, 707, 827, 923, 1034,	
1146, 1255	
Garner, H. V. and J. Wishart: Fertilizer Trials in 1929	793
Garratt, G. T.: Further Experiences of Grassland Manuring ..	778
Germany:	
Advertising Agricultural Produce	1020
Chesper Maize for Poultry Feeding	598
Cheese Control in East Prussia	1019
Flower Bulbs, Import Regulations	729
Mark Potato Movement	1223
Rationalization of Dairies	1135
Goats, see <i>Small Livestock</i> .	
Grading, see <i>Marketing</i> .	
Grass, see <i>Pasture</i> .	
Haldane, Sir William S.: Livestock in Relation to Tillage, Broad-	
cast Address	209
Hall, Sir Daniel:	
Research Scholarship Scheme	213
Research and the Breeding of Apples	765
Hay:	
Hay Harvest, Minimum Wage Rates for	292
Making	173
Herrod-Hempsall, W.: Blind Louse of the Honey-Bee	1176
Hey, G. L., and F. R. Petherbridge:	
Control of the Common Green Capsid Bug on Red Currants ..	1185
Winter Spraying for the Control of the Apple Capsid Bug ..	1078
Hitt, Thomas: An Eighteenth-Century Heathland Farmer ..	1198
Horne, F. R.: Life History of Broccoli	1100
Holland, Marketing Organization in	365
Collective Advertising of Dutch Horticultural Produce ..	1220
Horses, see <i>Livestock</i> .	
Housing:	
Agricultural Cottages	941
Cottages for Small Holdings	993
Howe, G. W.: Two Experiments on Tapioca Meal as Food for Pigs	885
Import and Export Regulations:	
Apples, Importation of American	510
Cherries, Importation of	308
Export of Breeding Stock 86, 87, 408, 703, 1049	
Flower Bulbs, Importation into Germany	729
Index Number, Agricultural, see <i>Agricultural Returns and Statistics</i> .	
Insect and Other Pests, see <i>Diseases and Spraying</i> .	
Insecticides, see <i>Spraying</i> .	
Iowa: "National Mark" for Butter	1129
Italy: Agricultural Experiment Stations	212
Jesse, R. H. B.: Observations on Nematode Parasites of Sheep in	
East Sussex	681
Keeble, Sir Frederick: New Methods of Testing Fertilizer Dis-	
tributors	439
Kitchin, A. W. Menzies: Economic Aspects of Fig Recording ..	957

	PAGE
Labour, see also <i>Wages</i> .	
Improvement of Farm Labour and its Management by	
Education	782
Labour for Manuring	801
Land Division, Report	638
Land Drainage, see <i>Drainage</i> .	
Latvia : Breeding of Pigs	917
Lawson, W. : Monthly Farm Notes	70, 172, 276, 394, 498, 616, 704, 824, 919, 1142, 1252
Leaflets, see <i>Publications</i> .	
Lee, L. L. : Soil Surveys and Their Utilization	653
Legislation, see <i>Acts of Parliament</i> .	
Library : Additions to, and Selected Contents of Periodicals	101, 201, 297, 521, 633, 741, 947, 1057
Lime, see <i>Manures</i> .	
Livestock, see also <i>Small Livestock and Diseases and Pests of Animals</i> :	
April Operations	70
Breeding Stock, Export	
Quarter ended December, 1929	86
" March, 1930	408
" June, 1930	723
" September, 1930	1049
Bullock Feeding on Sugar Beet Tops and Pulp	210
Calf Rearing	951
Cattle, Experiment in the Marketing of	144
Cattle, Immunization before Export	952
Dairy Cattle, Register, Vol. XIII	306
Dry Cows, Feeding of	833, 928
Factors Affecting Efficiency in Digestion	80
Farm Institute Livestock Judging Competitions	421
Horses, Exportation	111
Licensing of Stallions under the Horse Breeding Act, 1918	809
Livestock Improvement Scheme, Report for year ending	
March 31, 1930	456
Pig Breeding in Latvia	917
Pig Feeding, Value of Whole Milk and Separated Milk for	541
Pig Industry Council	49, 366, 1018
Pig-keeping in Kent	341
Pig-recording, Economic Aspects of	957
Rations for In-Pig Sows	643
Sheep, Feeding of Grass	501
Sheep, Nematode Parasites of	681
Sheep, Phosphorus Poisoning	56
Sheep Shearing	134
Sows and Their Litters, Feeding of	417
Tapioca Meal as Food for Pigs	885
Tillage, Livestock in Relation to	209
Winter Food Mixtures for Cows and Pigs	756
Young Farmers' Clubs International Cow Judging Competition	427
Loans, see <i>Credit</i> .	
Long, H. C. : Weeds of Grass Land	871, 985, 1107, 1192
Machinery :	
Combine Harvesters, Demonstrations of	421
Drainage Plough, Cuthbert Clarke's	571
Fertilizer Distributors, New Methods of Testing	439
Horticultural Machinery Demonstrations	652
Sheep Shearing	134
Stubble Cleaning	423
World Tractor Trials	426, 754
Maize, see <i>Feeding and Feeding Stuffs</i> .	
Malt, see <i>Cereals</i> .	
Mangolds, see <i>Root Crops</i> .	
Manures and Manuring :	
Acid Soils, Manures for	179
Basic Slag, Effect on Rush Growth	642

Manures and Manuring: (continued)		PAGE
Chalking Experiments		923
Farmyard Manure		1143
Fertilizers and Feeding Stuffs Act, 1926. Some Questions and Answers		50
Fertilizers, Residual Effects of		926
Fertilizer Trials in 1929		793
Fertilizer Distributors, New Methods of Testing		439
Further Experiences of Grassland Manuring		778
Lime, Magnesian		925
Lime, Varying Effect on Grass Land with Different Schemes of Manuring		663
Monthly Notes 74, 177, 707, 827, 923, 1034, 1146,		1255
Phosphates, Choice of		827
Potatoes, Manuring of		74
Prices of Artificial 79, 181, 280, 398, 502, 621, 712, 832, 927, 1038, 1150, 1260		
Sugar Beet, Manures for		177, 262
Marketing:		
Advertising Agricultural Produce in Germany		1020
Advertising Dutch Horticultural Produce, Collective		1220
Agricultural Marketing Bill 600, 891, 901, 950, 1018,		1234
American Marketing Act, The		1226
Apple Industry of Nova Scotia		703
Apples and Pears, National Mark 40, 235, 482, 593, 699, 817, 910, 1008, 1126, 1215		
Apples, Carton Packages for		146
Beef Grading and Marking in U.S.A.		1019
Beef, National Mark 42, 47, 141, 233, 353, 481, 591, 697, 814, 909, 1007, 1121, 1213		
Butter, Iowa "National Mark"		1129
Butter Marketing, Quality Control		238
Cash on Delivery Service		420
Cattle, Experiment in Marketing		144
Cheaper Maize for Poultry Feeding in Germany		598
Cheese Control in East Prussia		1019
Cheese, Home-Produced		1242
Cheese Marketing in England and Wales		822
Cherries, National Mark 367, 482, 593, 1125,		1217
Cider, National Mark 819, 1012,		1217
Co-operative Marketing Enterprises, Loans to		366, 1131
Cornish Broccoli Export Scheme		41
Dairy Rationalization in Germany		1135
Danish Committee on		363
Displays of Home Produce 49, 144, 700, 820, 1017, 1129,		1218
Dutch Horticultural Produce: Collective Advertising of		1220
Economic Series of Reports on		240, 597, 918
Eggs, National Mark 40, 46, 140, 233, 351, 480, 590, 697, 813, 908, 1006, 1120, 1209		
Fruit Crop Intelligence		105
Fruit Export Regulations of Nova Scotia		1019
Fruit Marketing Report		1141
Fruit, Peas and Beans (Canned), National Mark 237, 358, 483, 593, 699, 818, 911, 1011		
Fruit Schemes, Review of National Mark		906
Germany, Mark Potato Movement		1223
Grading, Effect on Canada's Food Products		147
Grocers and the National Mark		351
Grocer Students' Tour		360
Grocer Students' Travelling Scholarships		487
Hides and Skins, Report of Imperial Economic Committee on		915
"House that Jack Built"		846
International Commission of Agriculture and Organization of Marketing		1135
Jam Standards		917
Malt Products, National Mark		42, 236, 594, 1012

Marketing : (continued).	PAGE
Marketing and the National Mark, Address by Mr. A. W. Street	37
Marketing Demonstrations 49, 238, 360, 487, 596, 820, 1017, 1218	
Marketing Grants	599, 1222
Marketing Notes (Monthly) 45, 140, 233, 351, 480, 590, 697, 813, 908, 1006, 1120	
Marketing Organization	1132
Milk Grading for Sale, Report of Standing Committee	382
Milk Industry Reorganization	1018
Milk Inquiry Commission in British Columbia	490
Milk, Report of Standing Committee on Law relating	386
National Mark: Address by Secretary of Ministry to the Birmingham Rotary Club	1205
National Mark Booklet	595
National Mark Egg Central, Ltd.	45
New England "National Mark"	1022
Norway and Holland: Marketing Organization	364
Pig Breeding in Latvia	917
Pig Industry Council	49, 366, 1018
Popularity of National Mark Produce	820
Potato "Futures" Exchange	1225
Poultry (Dressed) Competition at Gloucester Show	1017
" " Grading and Marking	241
" " Marketing	377
" " National Mark .. 43, 352, 480, 699, 1006, 1213	
" " Report of Standing Committee of Council of Agriculture for England on Marketing of	385
Poultry Shaping and Cooling Plant	599
Publicity for National Mark Produce 359, 486, 595, 699, 819, 913, 1014, 1127, 1218	
Queensland, Compulsory Marketing	1223
Saskatchewan, Proposed Compulsory Wheat Pool	489
Scottish Milk Agency	1137
Scottish Opinion on Organized Marketing	1133
Standardization: Effect on Physical Markets	361
Standardization in Western Australia	363
Strawberries, National Mark 143, 251, 355, 482, 593, 1011, 1122, 1217	
Tomatoes and Cucumbers, National Mark 41, 144, 235, 355, 482, 817, 1009	
Union of South Africa: Agricultural Warehouse Act, 1930	702
" " Dairy Industry Control Act, 1930	701
" " Export Bounties on Butter and Cheese	1137
" " Packing and Marking of Agricultural Products, 1930	240
" " Public Auctions and Transactions in Livestock and Produce (Amendment) Act, 1930	239
United States Department of Agriculture: Foreign Intelligence Service	917
United States Marketing Policy	1135
Wheat Flour, National Mark 41, 143, 235, 357, 485, 594, 818, 911, 1011, 1027	
" " " " " Recipe for Bread made from	821
Market "Price," see <i>Prices</i> .	
Marsh, R. W., and J. G. Maynard: Black Currant Leaf Spot Disease and Its Control	255
Massee, A. M., and M. Beshir: Control of Apple Blossom Weevil	164
Maynard, J. G., and R. W. Marsh: Black Currant Leaf Spot Disease and Its Control	255
Meager, Leonard, and the "Mystery of Husbandry," 1907	879
Meat?	
Bacon Industry	604
Beef Grading and Marking in U.S.A.	1019
Beef, National Mark.. 42, 47, 141, 233, 353, 481, 591, 697, 814, 909, 1007, 1121	
Dressed Poultry, Grading and Marking	241
" " Report of Standing Committee on Marketing	365
" " National Mark	43, 352, 480, 697, 1006

	Page
Mercer, W. B. : Agricultural Education in Cheshire	553
Meteorology :	
Calendar Reform	206
Weather Conditions in relation to Sugar Beet cultivation	260
Middleton, A. D. : Grey Squirrel in the British Isles	1069
Miles, H. W., Control of the Cabbage Root Fly	1227
Milk, see <i>Dairying</i> .	
Milburn, T. : Farm Drainage Records	955
Minerals and Vitamins, Role in Stock Feeding	18, 115
Moore, W. C., and G. H. Pethybridge : " Dry Pickling " Seed Wheat to prevent Bunt	429
National Mark, see <i>Marketing</i> .	
Natural History : Duration of Antenatal Life	11
Norway, Marketing Organization in	364
Notes on Feeding Stuffs, see <i>Feeding and Feeding Stuffs</i> .	
Notes on Manures, see <i>Manures and Manuring</i> .	
Nova Scotia, Apple Industry of	703
Fruit Export Regulations	1019
Notices of Books, see also <i>Publications and Library</i> :	
Agricultural Co-operation in England	1162
Agricultural Extension System of U.S.A.	1161
Agricultural Note-Book	1161
Agricultural Crisis and the Way Out	1057
Agriculture of Rumania during the War	518
Animal Breeding	737
Bath and West and Southern Counties Society's Journal	198
Beef Cattle : Feeding and Management in the Corn Belt States	944
British Goat Society's Year Book, 1930	516
British Poultry Husbandry : Its Evolution and History	943
County School : Its Practice and Problems	99
Crop Production and Management	1162
Dairy Cattle : Selection, Feeding, Management	740
Dairy Enterprises	520
Dairy Farming : Most Milk and Profit per Acre	519
Dispersal of Plants throughout the World	945
East Yorkshire : A Study in Agricultural Geography	1162
Economics of Farm Relief	98
Encyclopædia of Agriculture	295
English Plough	734
Essentials in the Selection of Meat	946
Essex County Farmers' Year Book, 1930	197
Factors affecting Price of Potatoes in Great Britain	739
Farm Export Debenture Plan	199
Farm and Industrial Tractors	294
Flour Quality	97
Fungous Diseases of Plants	296
Further Illustrations of British Plants	733
Gardener's Year Book, 1930	197
Growing Tree and Small Fruits	517
Heredity in Livestock	733
History of British Friesian Cattle	1161
History of the Corn Laws, 1660-1846	735
Indexes to Literature of Food Investigation	302, 1162
Index Londonensis	201
Industrial Arbitration in Great Britain	200
Inspection of Fish, Poultry, Game, Fruit, Nuts and Vegetables	520
International Agricultural Legislation Year Book	514
International Directory of Pedigree Stock Breeders	732
International Year Book of Agricultural Statistics	1045
Judging Poultry for Production	1163
Management of Farm Poultry	944
Manual of Bacterial Plant Pathogens	1055
Modern Fruit Growing	199
National Farmers' Union Year Book, 1930	198

I. A. R. I. 75.

IMPERIAL AGRICULTURAL RESEARCH
INSTITUTE LIBRARY
NEW DELHI.

Date of issue.	Date of issue.	Date of issue.
1917	1917	1917
1918	1918	1918
1919	1919	1919
1920	1920	1920
1921	1921	1921
1922	1922	1922
1923	1923	1923
1924	1924	1924
1925	1925	1925
1926	1926	1926
1927	1927	1927
1928	1928	1928
1929	1929	1929
1930	1930	1930
1931	1931	1931
1932	1932	1932
1933	1933	1933
1934	1934	1934
1935	1935	1935
1936	1936	1936
1937	1937	1937
1938	1938	1938
1939	1939	1939
1940	1940	1940
1941	1941	1941
1942	1942	1942
1943	1943	1943
1944	1944	1944
1945	1945	1945
1946	1946	1946
1947	1947	1947
1948	1948	1948
1949	1949	1949
1950	1950	1950
1951	1951	1951
1952	1952	1952
1953	1953	1953
1954	1954	1954
1955	1955	1955
1956	1956	1956
1957	1957	1957
1958	1958	1958
1959	1959	1959
1960	1960	1960
1961	1961	1961
1962	1962	1962
1963	1963	1963
1964	1964	1964
1965	1965	1965
1966	1966	1966
1967	1967	1967
1968	1968	1968
1969	1969	1969
1970	1970	1970
1971	1971	1971
1972	1972	1972
1973	1973	1973
1974	1974	1974
1975	1975	1975
1976	1976	1976
1977	1977	1977
1978	1978	1978
1979	1979	1979
1980	1980	1980
1981	1981	1981
1982	1982	1982
1983	1983	1983
1984	1984	1984
1985	1985	1985
1986	1986	1986
1987	1987	1987
1988	1988	1988
1989	1989	1989
1990	1990	1990
1991	1991	1991
1992	1992	1992
1993	1993	1993
1994	1994	1994
1995	1995	1995
1996	1996	1996
1997	1997	1997
1998	1998	1998
1999	1999	1999
2000	2000	2000
2001	2001	2001
2002	2002	2002
2003	2003	2003
2004	2004	2004
2005	2005	2005
2006	2006	2006
2007	2007	2007
2008	2008	2008
2009	2009	2009
2010	2010	2010
2011	2011	2011
2012	2012	2012
2013	2013	2013
2014	2014	2014
2015	2015	2015
2016	2016	2016
2017	2017	2017
2018	2018	2018
2019	2019	2019
2020	2020	2020
2021	2021	2021
2022	2022	2022
2023	2023	2023
2024	2024	2024
2025	2025	2025
2026	2026	2026
2027	2027	2027
2028	2028	2028
2029	2029	2029
2030	2030	2030
2031	2031	2031
2032	2032	2032
2033	2033	2033
2034	2034	2034
2035	2035	2035
2036	2036	2036
2037	2037	2037
2038	2038	2038
2039	2039	2039